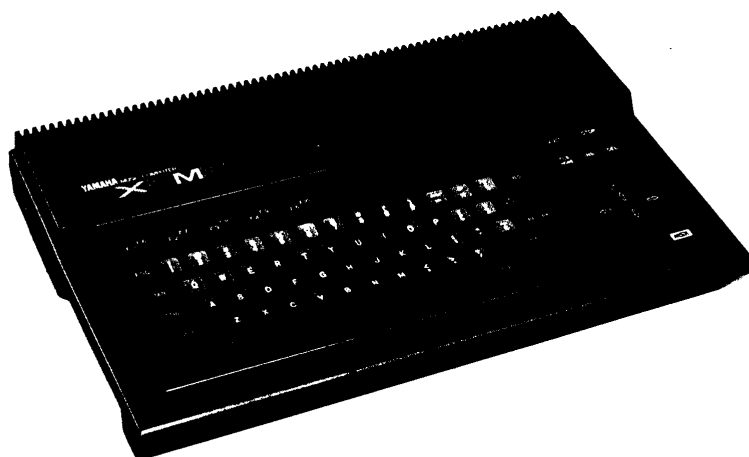


# MUSIC COMPUTER CX-5M II

## SERVICE MANUAL



CX-5M IIC  
CX-5M IIE  
CX-5M IIF  
CX-5M IIA  
CX-5M IIB  
CX-5M IIP

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SINCE 1887



**YAMAHA**

NIPPON GAKKI CO., LTD. HAMAMATSU, JAPAN  
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## ■ MSX COMPUTER ACCORDING TO AREA

There are different models of YAMAHA MSX COMPUTER according to area, this manual refer to the computer as only the CX-5MII, referring to all models. Where reference to particular model is called for, the specific model number pertaining to the area in question will be used. The different model numbers, and the area to which they pertain, are as follows.

CX-5MIIC . . . . . Canada . . . . . (NTSC)  
CX-5MIIE . . . . . United Kingdom . . . . . (PAL-I)  
CX-5MIIA . . . . . Australia and New Zealand . . . . . (PAL-B)  
CX-5MIIF . . . . . France . . . . . (PAL-G)  
CX-5MIIB . . . . . Italy . . . . . (PAL-G)  
CX-5MIIP . . . . . Spain . . . . . (PAL-G)

## ■ SCREEN DISPLAY

Display mode (on the BASIC language mode)

MODE		Resolution	Size	Patterns Number	Specified Color	Sprite	Characters
Text I (Screen 0)	MAX	256 x 192	6 x 8	256	2 out of 16 colors	No	40 x 24
	Suggested values	240 x 192					37 x 24
Text II (Screen 0)	MAX	512 x 192	6 x 8	256	2 out of 16 colors	No	80 x 24
	Suggested values	480 x 192					
Text (Screen 1)	MAX	256 x 192	8 x 8	256	16 colors	Yes	32 x 24
	Suggested values	240 x 192					29 x 24
Graphic (Screen 2)	MAX	256 x 192	8 x 8	768	16 colors	Yes	32 x 24
	Suggested values	240 x 192					29 x 24
Multi-color (Screen 3)	MAX	64 x 48blk	4 x 4 per block	—	16 colors	Yes	—
	Suggested values	60 x 40blk					

Suggested values: The eight pixels form the left and the sixteen pixels from the right of the horizontal line are not used by the software.

## SPECIFICATION

### CPU

Type:	LH0080A (Z80A compatible)
Clock:	3.579545MHz
Wait:	1 wait in M1 cycle
Interrupt:	NMI-not used INT-accept interrupts from VDP and cartridge SLOT The interrupt mode is Z80 mode 1. The interval of the interrupt is 50Hz (NTSC: 60Hz).
Reset:	Power on reset and reset switch.

### MEMORY

Main Memory:	128 Kbyte (128 Model)
(RAM)	64 Kbyte ( 64 Model)
BASIC ROM:	32 Kbyte (MSX1-BASIC)
Sub ROM:	16 Kbyte (for 80 Chara)
Video RAM:	16 Kbyte

### VIDEO DISPLAY Video Display Processor (VDP)

Type:	V9938
Character Set:	256 alphanumeric and graphic characters
Color:	16 colors
Text mode:	SCREEN 0 or SCREEN 1
Capability:	24 lines by up to 80 columns (Software selectable)
Resolution:	256 x 192 pixels (non interlace)

### INPUTS AND OUTPUTS

Keyboard:	Stroke type step sculpture keyboard. Alphanumeric and special characters . 48 Control and special effect keys . . . . 16 Cursor movement keys . . . . . 4 Function keys (programmable) . . . . 5 CAPS lock key with LED indicator
Cassette Interface:	8 pin DIN female connector Baud rate 1200/2400 BPS selectable by software, FSK format. With remote control (Cassette motor ON/OFF)
Printer Interface:	Standard centronics 8-bit parallel TTL logic level 14 pin female connector
Univarsal I/O Interface:	2 ports (JOYSTICK) 9 pin male connectors TTL logic level
Audio/Video Output:	1) MONITOR output RCA type pin connector CX-5MIIE, F, A, B, P PAL composite video output 75 ohm CX-5MIIC NTSC composite video output 75 ohm 2) SOUND output RCA type pin connector CX-5MIIC, E, F, A, B, P 8 octaves 3 tones + noise BEEP sound 3) RF output RCA type pin connector CX-5MIIC: NTSC (VHF3, 4) CX-5MIIA: PAL (VHF3, 4) CX-5MIIE, F, B, P : PAL (UHF36) 4) RGB output 8 pin DIN female connector CX-5MIIC, E, F, A, B, P 5) Color or Block/White switch Monitor and RF output used

Upper SLOT A, B:	SLOT 1, 2 50 pin MSX standard female connector
SIDE SLOT:	SLOT 33 60 pin edge card connector FM sound unit
BILT in ROM SOCKET:	SLOT 30 30 pin plug right angle type

### FM SOUND SYNTHESIZER UNIT

Number of Preset Voices:	46
Simultaneous Notes:	Up to 8 notes
Audio L/R Outputs:	-9 ± 2dB, 1.8kΩ RCA-pin jacks
MIDI IN/OUT:	5 pin DIN female connectors
Music Keyboard:	For connection to an optional YK-01 or YK-10, 20 music keyboard. 20 pin male connector

### POWER SUPPLY UNIT CAPACITY

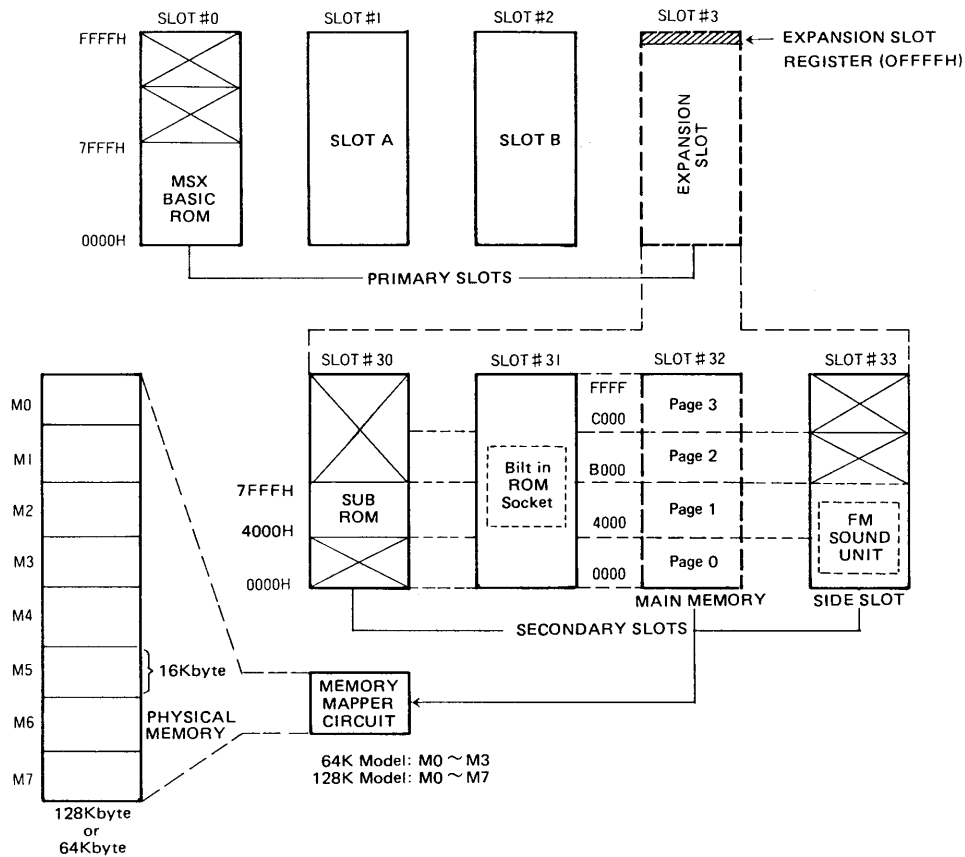
+5V ± 5% 2.0A
+12V ± 10% 0.3A
-12V ± 10% 0.16A

### GENERAL SPECIFICATIONS

Line voltage:	CX-5MIIC 117V ± 15%, 50/60Hz CX-5MIIE, F, A 220 ~ 240V, 50/60Hz CX-5MIIB, P 120V ± 10%, 50/60Hz 220V ± 10%, 50/60Hz Switchable
Power input:	10W 18W MAX
Measurement:	440(W) x 285(D) x 98(H)
Weight:	3.5 kg (about)
AC cable:	2,000 mm + 50 mm with AC plug (CX-5MIIC, F, A, B, P)

## ■ CX-5M II BRIEF DESCRIPTION

### • Memory map and slot area



- \* Terminology: Primary slot . . . . . Slot which is enabled by slot select register with in MPS chips (I/O address 0A8H)  
Secondary slot . . . . . Slot which is enabled by expansion slot register placed at 0FFFFH (Memory address)  
Page . . . . . Block of memory (maximum 16KB) in each slot. A slot is divided into 4 pages.

- \* Every select signal of each slot is output from MPS (100 pin LSI: S-3527)  
MSX BASIC ROM . . . . .  $\overline{\text{ROMCS}}$   
SLOTT A, SLOTT B . . . . .  $\overline{\text{SLT1}}, \overline{\text{SLT2}}, \overline{\text{CS1}}, \overline{\text{CS2}}, \overline{\text{CS12}}$   
Extended BASIC ROM . . . . .  $\overline{\text{SLT30}} (\text{SUB ROM})$   
Built-in ROM socket . . . . .  $\overline{\text{SLT31}}, \overline{\text{CS1}}, \overline{\text{CS2}}, \overline{\text{CS12}}$   
Main memory area . . . . .  $\overline{\text{MPX}}, \overline{\text{WE}}, \overline{\text{RAS}}, \overline{\text{CAS2}}$   
Side slot . . . . .  $\overline{\text{SLT33}}, \overline{\text{CS1}}, \overline{\text{CS2}}, \overline{\text{CS12}}$

- \* With the memory mapper circuit, the block by the unit of 16K bytes in the PHYSICAL MEMORY space can be mapped freely on each page of the MAIN MEMORY space.

- **I/O port area map**

The CPU (Z80A) has a 256-bytes area as I/O ports. Under the MSX specification, the 256-bytes (00H ~ FFH) are reserved in the following way:

		Address	R/W	Functions	
FFH	MAP Register	FFH	R/W	Map register for PAGE 3	MAP Register
F0H		FEH	R/W	Map register for PAGE 2	
E0H		FDH	R/W	Map register for PAGE 1	
D0H		FCH	R/W	Map register for PAGE 0	
C0H					
B0H		ABH	W	Command register	PPI chips Compatible in MPS
A8H	PPI	AAH	W	MSX system control output	clips
A0H	SSG	A9H	R	Reads return signals from keyboard	
98H	VDP	A8H	R/W	Primary SLOT select register	
90H	Printer	A2H	R	DATA read	SSG chips Compatible in MPS
88H		A1H	W	DATA write	chips
80H		A0H	W	SSG register address latch	
00H		9BH	R/W	DATA register Read/write	VDP (V9938)
		9AH	W	DATA write	TMS9918 Compatible
		99H	R/W	Status read/command write	
		98H	R/W	V-RAM DATA read/write	
		91H	W	Print DATA latch output	TTL Logic level
		90H	R/W	Strobe out/status in	in MPS chips

All I/O port addresses shown in the above I/O port area map are located within the 100-pin LSI (S-3527). The LSI encloses the  $\mu$ PD-8255A (PPI), YM2149 (SSG), and printer control circuit shown in the map. In addition, it has memory area and slot control functions.

- \* **MPS (S-3527) I/O ports register**

All the following MPS (S-3527) I/O ports provide the same port control functions as the PPI ( $\mu$ PD-8255AC) and SSG (YM2149):

I/O address A8H (PA0 ~ PA7): Slot select data register  
 A9H (PB0 ~ PB7): Keyboard scanning data input (return) port  
 AAH (PC0 ~ PC3): Keyboard scanning data output port  
 (PC4): Data recorder (cassette recorder) motor ON/OFF control bit  
 (PC5): Output FSK specification data to data recorder (cassette)  
 (PC6): CAPS LED control bit (on when "L")  
 (PC7): Emits beeping sound through 1 bit output

I/O address A0H ~ A2H

Internal SSG register number: 10H

(IOA0 ~ IOA5): Input port for general purpose. Input/output port (JOYSTICK 1, 2) data scanning.

(IOA6): Not used

(IOA7): Input port for data from data recorder (cassette).

Internal SSG register number: 11H

(IOB0 ~ IOB3): JOYSTICK port scanning data output.

(IOB4): JOYSTICK 1 strobe signal output.

(IOB5): JOYSTICK 2 strobe signal output.

(IOB6): JOYSTICK 1 or 2 select signal

"L" . . . . JOYSTICK 1 selected

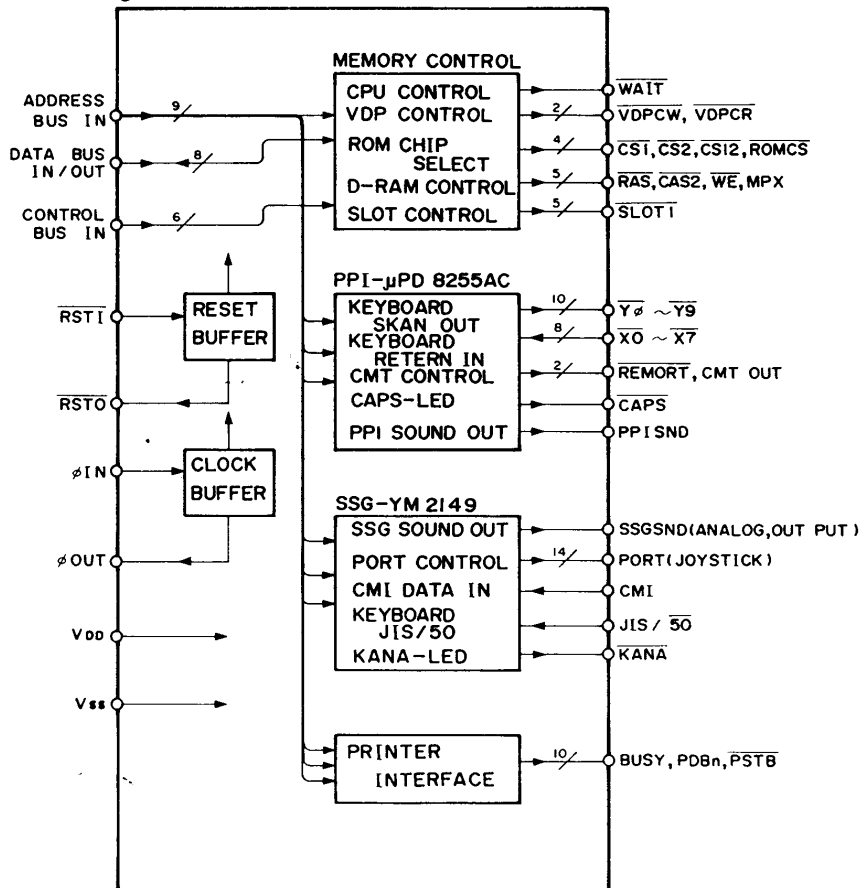
"H" . . . . JOYSTICK 2 selected

- MPS (MSX Port Controller and Sound Generator): S-3527

The MPS (S-3527) is a 100-pin CMOS LSI specifically developed to support MSX. With a built-in PPI ( $\mu$ PD-8255) and SSG (YM-2149), the MPS provides the following system controller functions:

- Memory and slot area control
- ROM (MSX-BASIC ROM: 32K bytes) access  
ROMCS
- RAM (D-RAM: 64K bytes) access  
RAS, MPX, WE, CAS2
- Basic slot (# 1, # 2, # 3) control . . . Primary slot control
- Selection and control of expansion slots (# 00, # 01, # 02, # 03) . . . Secondary slot
- I/O area (I/O peripheral) control
- Printer control  
BUSY, PDBn, PSTB
- VDP (video display processor) control  
VDPCW, VDPCR
- With a built-in PPI ( $\mu$ PD-8255) and SSG (YM-2149)
- 3-Channel 3-level voice and noise output
- Dual joystick (or general-purpose port) control
- Data recorder I/O control
- Keyboard control
- Insertion of 1 WAIT in the CPU M1 cycle
- RESET signal processing
- CPU clock (3.57954 MHz) input

« MPS Block Diagram »



\* Removing MPS

- 1 Cut the legs with a cutter, being careful not to damage the pattern, as show in Figure A or fuse the solder with a special soldering iron as in Figure B.
- 2 After removing the MPS, desolder it with care not to damage the pattern.

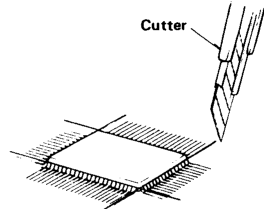


Fig. A

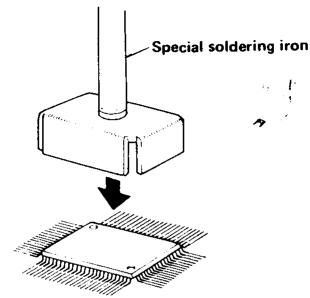


Fig. B

• VDP (Video Display Processor): V-9938

The VDP (V-9938) is a 64-pin MOS LSI developed for MSX2 concurrently with the MPS. The VDP is run on the MSX1 specifications. It provides the following functions:

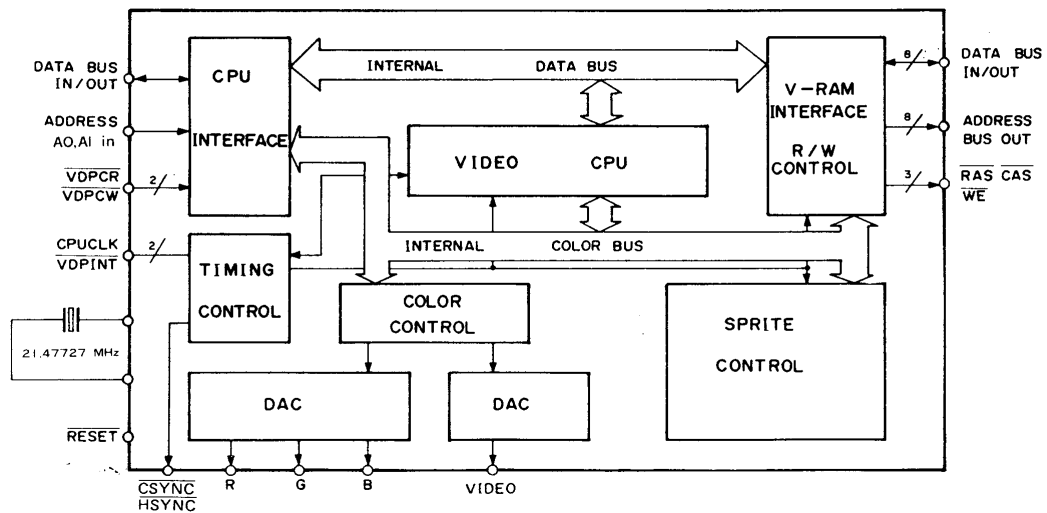
To provide software compatibility with the VDP (TMS9918A).

To generate linear RGB signals and composite video signals. Here, various video signals are produced from the linear RGB signals without using the composite video signals.

To use 16K bytes as video-RAM.

To supply a CPU clock (3.579545 MHz). The clock generated by a quartz oscillator (21.47727 MHz) connected to pins 63 and 64 is internally demultiplied and output to CPU clock pin 8.

« VDP Block Diagram »



## ■ MUSIC FUNCTIONS (SFG-05 COMPATIBLE)

### ● Audio characteristics

Output level	1 tone	4 tone	8 tone
LINE OUT (L, R)	- 16 ± 2dBm	- 11 ± 2dBm	- 9 ± 2dBm
Standard BUS (59PIN)	- 17 ± 2dBm	- 12 ± 2dBm	- 10 ± 2dBm

Condition : KEY 440Hz to 880Hz, 1 to 8 tones when FM standard FLUTE tone is selected.

Note : SOUND-IN of standard BUS is 49 pin and that of SIDE SLOT is 59 pin.

### ● Filter characteristics

Condition	440Hz	1KHz	2.7KHz	10KHz	16KHz	20KHz
CTI [iC101 9pin] OFF (L or R-ch)	+ 7.5 ± 1dB			+ 6.0 ± 1dB	+ 4.2 ± 1dB	+ 2.8 ± 1dB
CTI [iC101 9pin] ON (R-ch only)	+ 7.5 ± 1dB	+ 6.3 ± 1dB	+ 1.5 ± 1dB	- 9.5 ± 1dB		

### ● Output impedance

LINE OUT	1.8KΩ
BUS OUT	1.0KΩ

### ● Music function I/O address map

Address	Input						OUTPUT	Internal register
	CS0	RD	WT	A2	A1	A0	OPM	
	/	/	/	/	/	/	1	/
		1	1	/	/	/		
3FF0H	0	0	1	0	0	0	0	OPM STATUS REGISTER * in YM2195 (OPM)
	0	1	0	0	0	0		OPM ADDRESS REGISTER * in YM2195 (OPM)
3FF1H	0	0	1	0	0	1		OPM DATA REGISTER * in YM2195 (OPM)
	0	1	0	0	0	1		OPM DATA REGISTER * in YM2195 (OPM)
3FF2H	0	1	0	0	1	0	1	Register for data latched to ST0 to ST7 output ports
	0	0	1	0	1	0		Data buffer for SD0 to SD7 input ports
3FF3H	0	1	0	0	1	1		MIDI IRQ VECTOR ADDRESS REGISTER
	/	0	1	0	1	1		/
3FF4H	0	1	0	1	0	0		EXTERNAL IRQ VECTOR ADDRESS REGISTER
	/	0	1	1	0	0		/
3FF5H	0	0	1	1	0	1		MIDI standard UART DATA READ BUFFER
	0	1	0	1	0	1		MIDI standard UART DATA WRITE BUFFER
3FF6H	0	0	1	1	1	0		MIDI standard UART STATUS REGISTER
	0	1	0	1	1	0		MIDI standard UART COMMAND REGISTER
3FF7H	/	/	/	1	1	1		/



## ■ MIDI RECEIVING AND TRANSMITTING DATA

The unit receives the following MIDI signals (when CALL MUSIC is functioning).

### ● MIDI receiving data

#### ● Channel message

When the MIDI receiving channel is specified for each instrument, the unit receives the following MIDI signals transmitted through the specified channel.

##### ① Key-OFF

Status	1 0 0 0 n n n n (8 n H)	n = channel No.
Note No.	0 k k k k k k k	k = 0 (C-2) ~ 127 (G8)
Velocity	0 v v v v v v v	v : Neglected

##### ② Key-ON

Status	1 0 0 1 n n n n (9 n H)	n = channel No.
Note No.	0 k k k k k k k	k = 0 (C-2) ~ 127 (G8)
Velocity	0 v v v v v v v	v = 0 Key-OFF v = 1 ~ 127 Key-ON

##### ③ Control change

Status	1 0 1 1 n n n n (B n H)	n = channel No.
Control No.	0 c c c c c c c	c = control No.
Control Value	0 v v v v v v v	

C = 5 Portamento time (SOLO mode only)  
 C = 7 Volume  
 C = 64 Sustain switch  
 C = 65 Portamento switch (SOLO mode only)  
 C = 125 All notes OFF

##### ④ Program change

Status	1 1 0 0 n n n n (C n H)	n = channel No.
Program No.	0 p p p p p p p	p = program No. (0 ~ 47)

#### ● System real time message

The unit receives the following system real time messages when the play clock is MIDI.

##### ① Timing clock

Status	1 1 1 1 1 0 0 0 (F 8 H)
--------	-------------------------

##### ② Start

Status	1 1 1 1 1 0 1 0 (F A H)
--------	-------------------------

##### ③ Continue start

Status	1 1 1 1 1 0 1 1 (F B H)
--------	-------------------------

##### ④ Stop

Status	1 1 1 1 1 1 0 0 (F C H)
--------	-------------------------

### ● MIDI transmitting data

The unit transmits the content played by the music keyboard and reproduction data through MIDI channel 1.

#### ● Channel voice message

##### ① Key-OFF/Key-ON

Status	1 0 0 1 0 0 0 0 (90 H)	
Note No.	0 k k k k k k k	k = 0 (C-2) ~ 127 (G8)
Velocity	0 v v v v v v v	v = 0 key-OFF v = 1 ~ 127 key-ON

#### ● System real time message

The unit outputs the following system real time messages when the play clock is INTERNAL..

##### ① Timing clock

Status	1 1 1 1 1 0 0 0 (F 8 H)
--------	-------------------------

##### ② Start

Status	1 1 1 1 1 0 1 0 (F A H)
--------	-------------------------

##### ③ Stop

Status	1 1 1 1 1 1 0 0 (F C H)
--------	-------------------------

Function ...		Transmitted		Recognized				Remarks
		Synthe.	Sequencer	Solo	Poly	Seq	Rh.	
Basic	Default	1		1	1*	Same	X	* #2 + #4 off
Channel	Changed	1-16		1-16	1-16	as #1	X	
Mode	Default	3			3		X	
	Messages	X			X		X	
	Altered	*****			X	*	X	
Note		36-84	0-127		0-127		X	
Number	True voice	*****			0-127	*	X	
Velocity	Note ON	X V=64	0 V=1-127		O		X	
	Note OFF	X 9nH	V=0		X		X	
After	Key's	X			X			
Touch	Ch's	X			X			
Pitch Bender		X			X			
	(5)	X		O	X		X	Portamento Speed
	(7)	X		O	O		X	Volume
	(64)	X		O	O		X	Sustain ON/OFF
Control	(65)	X		O	X		X	Portamento ON/OFF
Change								
Prog		X		O	0-47		X	
Change	True #	*****			0-47		X	
System Exclusive		X			X			
System	Song Pos	X			X			
	Song Sel	X			X			
Common	Tune	X			X			
System	Clock	O (Internal Mode)		O (MIDI Mode)				
Real Time	Commands	O (Internal Mode)	*	O (MIDI Mode)			*	Except FBH
Aux	Local ON/OFF	X			X		X	
	All Notes OFF	O (126, 127, 123)			O (123)		X	
Mes-	Active Sense	X			X		X	
sages:	Reset	X			X		X	
Notes		In Split/Dual-Mode (of POLY Mode), MIDI Ch# of Inst#2 is same as Inst#1'S						
		In order to clear all notes, we send [A11 notes OFF (126, 127, 123)]						

Mode 1 : OMNI ON, POLY      Mode 2 : OMNI ON, MONO      ○ : Yes  
Mode 3 : OMNI OFF, POLY      Mode 4 : OMNI OFF, MONO      × : No

## ■ SLOT A AND SLOT B ASSIGNMENT

Pin No.	Pin Name	I/O	Description
1	CS1	O	Select Signal for ROM 4000H-7FFFH
2	CS2	O	Select Signal for ROM 8000H-BFFFH
3	CS1, 2	O	Select Signal for ROM 4000H-BFFFH
4	SLTSL	O	Slot Select Signal
5	N/C	—	Inhibited to use
6	RFSH	O	Dinamic RAM refresh signal
7	EXT WAIT	I	WAIT request, open collector signal
8	EXT INT	I	Maskable interrupt request, open collector signal
9	MT	O	M1 signal from CPU
10	BUSDIR	I	Direction Control for external Bus Buffer
11	TORQ	O	I/O request from CPU
12	MERQ	O	Internal memory request from CPU
13	WR	O	Write request from CPU
14	RD	O	Read request from CPU
15	RESET	O	System Preset signal
16	N/C	—	Inhibited to use
17	A9	O	Address Bus signal
18	A15	O	
19	A11	O	
20	A10	O	
21	A7	O	
22	A6	O	
23	A12	O	
24	A8	O	
25	A14	O	
26	A13	O	
27	A1	O	
28	A0	O	
29	A3	O	
30	A2	O	
31	A5	O	
32	A4	O	
33	D1	I/O	Data Bus signal
34	D0	I/O	
35	D3	I/O	
36	D2	I/O	
37	D5	I/O	
38	D4	I/O	
39	D7	I/O	
40	D6	I/O	
41	GND	—	Ground
42	CLOCK	O	System Clock 3.579545MHz
43	GND	—	Ground
44	SW1	—	System protection
45	+5	—	Power Supply +5V
46	SW2	—	System protection (Note: SW1 and SW2 is in connection when Cartridge is inserted.)
47	+5	—	Power Supply +5V
48	+12	—	Power Supply +12V
49	SOUND IN	I	Sound input line (—5dbm) mixed with PSG sound and output
50	—12	—	Power Supply —12V

### • SIDE SLOT assignment

Pin No.	Pin Name	I/O	Description
1	SOUND OUT	O	Mixing Sound out of SSG, PP1
2	GND	—	Ground
3	GND	—	Ground
4	NC	—	Non connect
5	NC	—	
6	NC	—	
7	VIDEO	O	Video Out
8	NC	—	Non connect
9	NC	—	
10	NC	—	
11 ~ 60			Exactly same as regular slot

## ■ DISASSEMBLY PROCEDURES

- *Before Proceeding with Repair:*

- 1 Detach the side slot unit or cover.
- 2 Remove the screw in the center of the bottom case.
- 3 Remove the built-in ROM cartridge cover. If a ROM cartridge has been installed, remove it also.
- 4 Uncover the backup battery cover, remove the battery. (only MSX<sub>2</sub> Version)

### 1) Top Case Removal

- 1 The top case can be lifted by pushing it at claws with a standard screwdriver as shown in Figure A. There are four claws. Release them one by one.
- 2 After releasing all the four claws, detach the top case by lifting it a little on the rear side. The top case is fixed on the front side at the claw as shown in Figure B. Never use undue force to release it.

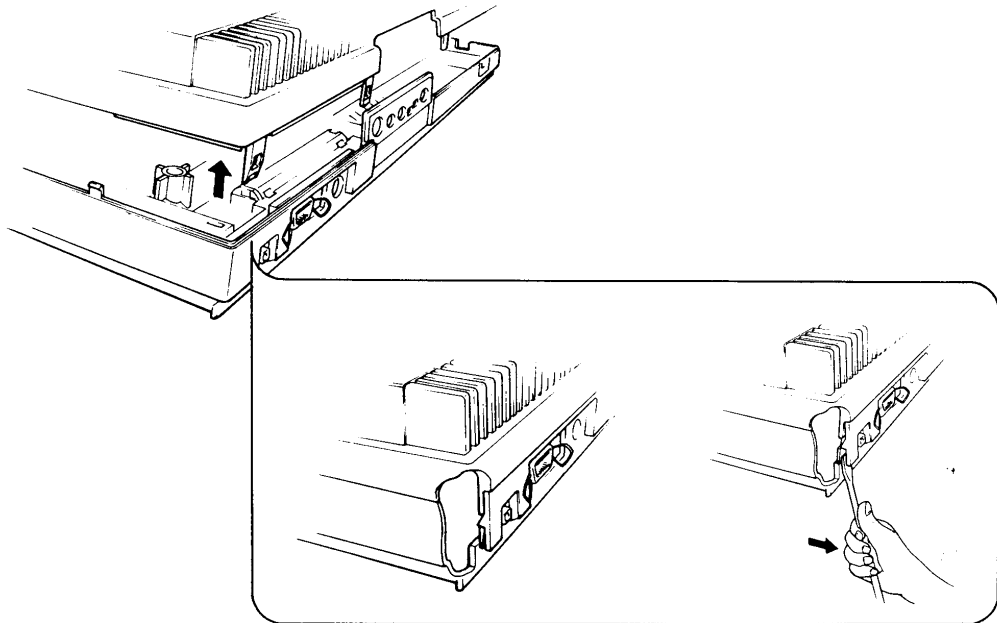


Fig. A

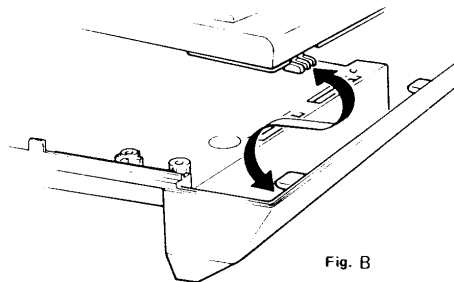
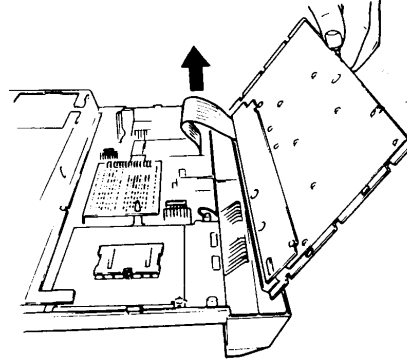
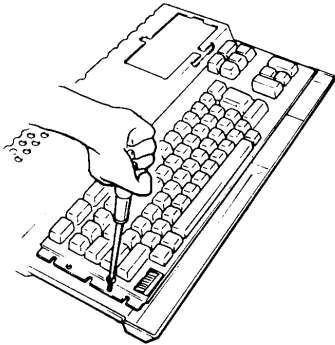


Fig. B

## 2) Keyboard Unit Removal

- 1 Remove four screws on both sides (four in total) of the keyboard unit.
- 2 Lift off the keyboard unit, slowly removing the flat cable from the CPU circuit board.
- 3 Remove Upper shield (only CX-5MIU, G)



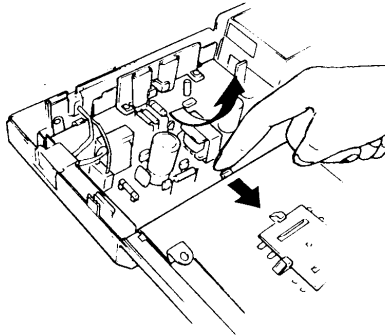
### • Board and Unit Removal Procedures

Remove the boards and units in the following sequence. Reverse the removal procedures to reinstall them.

- Step 1) Power supply unit removal
- Step 2) Video module unit removal
- Step 3) Side slot earth plate removal
- Step 4) Main CPU board removal
- Step 5) Bottom shield removal

## 3) Power Supply Unit Removal

- 1 Pull out the power connector attached to the power supply unit. Next, disconnect the AC inlet (power switch and power cable). Then, pull out the connector (bundled wires) from the CPU circuit board.
- 2 Remove four screws. Next, pulling forward the stopper claw extending from the bottom case, lift the CPU board on the front side. Then, remove the power supply unit by pulling it forward as a whole.



#### 4) Video Module Unit Removal

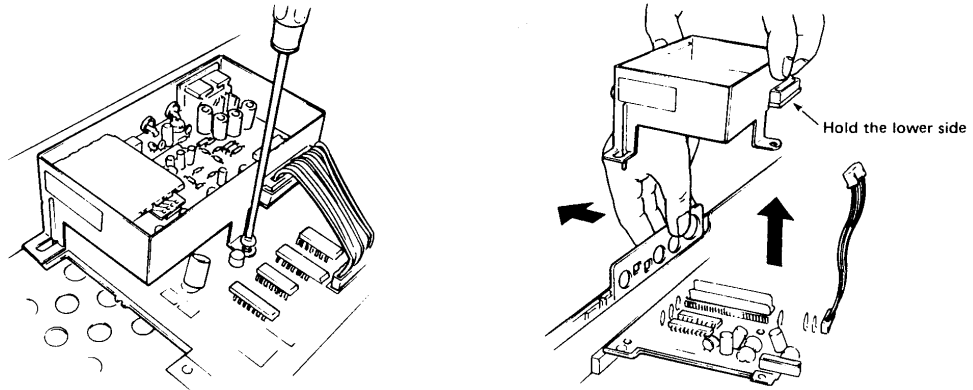
1 Pull out the connector from the CPU circuit board.

2 Remove two screws.

3 Pushing the rear panel inward a little, lift off the video module unit.

(The video module unit has legs as shown. Be careful not to damage them during removal.)

\* In attaching the connector to the video module unit, insert it while holding the lower side of the circuit board as it is easily cracked.

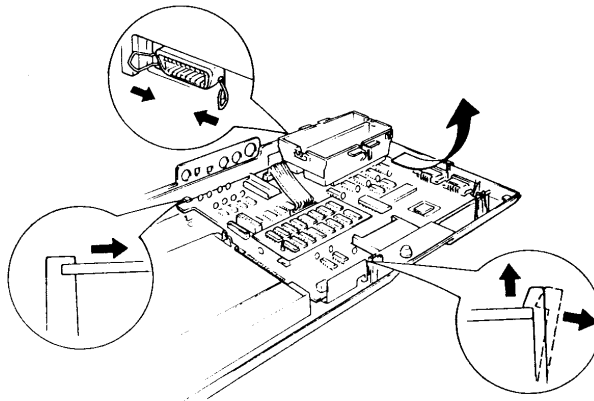


#### 5) CPU Circuit Board Removal

1 Remove seven screws securing the CPU circuit board in position.

2 Remove the side slot earth plate.

3 Release the two stopper claws extending from the bottom case by lifting the board a little on the front side. Then, remove the CPU circuit board by pulling it forward. Note that the in CPU circuit board is also secured in position by two stopper claws from the bottom case. The printer connector stoppers may be secured with a rubber band to facilitate servicing.



\* The video RAM circuit board and the main RAM circuit board are screwed to the bottom case by a grounding plate each. Follow the steps below to remove these boards.

#### 6) Video RAM Circuit Board Removal

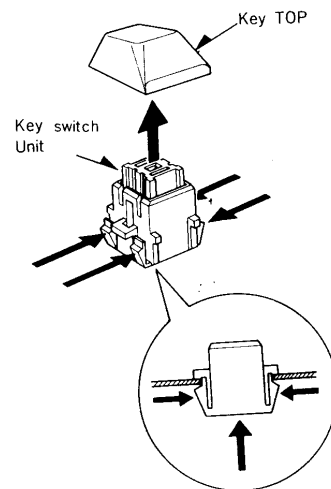
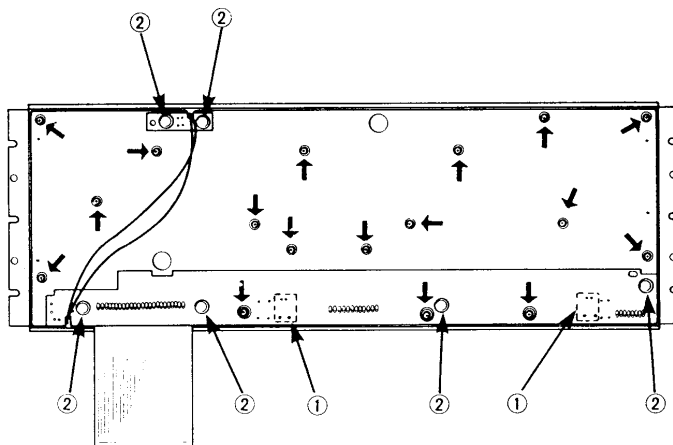
- 1 Remove one screw securing the video modulation unit, or remove the video modulation unit. Next, release the board stopper claws.
- 2 Detach the video RAM circuit board from the CPU circuit board connector.

#### 7) Main RAM Circuit Board Removal

- 1 Remove one screw securing the power supply unit, or remove the power supply unit.
- 2 Remove the side slot earth plate.
- 3 Next, release the board stopper claws and detach the main RAM circuit board from the CPU circuit board connector.

#### 8) Overhauling Keyboard Unit

- 1 Desolder S64, S63, D2, and D1 (CAPS and CODE key switches and LEDs) on the sub-circuit board ① .
- 2 Raise the sub-circuit board by removing the six plastic pins securing the sub-circuit board and the power LED. Extract the CN2 and CN3 flat cables at this time ② .
- 3 Remove the switch frame by unscrewing 17 special screws.
- 4 Pull out the keytops slowly as shown.
- 5 The key switch unit can be removed by holding it on the left and right claws and pushing them inward.



## ■ ADJUSTMENTS

Adjustment	Equipment required	Measure at	Adjust	Readings
+5V supply voltage	DVM (Digital voltmeter)	Pin #4 and 7 of connector CN2, CPU board	VR101 power supply	+5V $\pm$ 0.25V
Clock frequency	Frequency counter	Pin #6 of Z80A CPU		3.579545MHz $\pm$ 500Hz

Notes) Check AC line voltage to insure that it is specification voltage  $\pm$  10%.  
The adjustment for +5V supply voltage should be made while the circuitry of the CX-5MII is connected.

### ● Measurement

Item	
Conditions	<ul style="list-style-type: none"> <li>• Connect power circuit to CPU board.</li> <li>• Apply no load to each slot (game cartridge, etc.) of CPU board.</li> <li>• Don't connect peripheral equipments (printer, JOYSTICK, etc.).</li> </ul>
Voltage	+5V $\pm$ 5%
Voltage to be confirmed	<ul style="list-style-type: none"> <li>• -12V (1 pin) &amp; GND: -12V <math>\pm</math> 12.5%</li> <li>• +12V (2, 3 pin) &amp; GND: +12V <math>\pm</math> 12.5%</li> </ul>

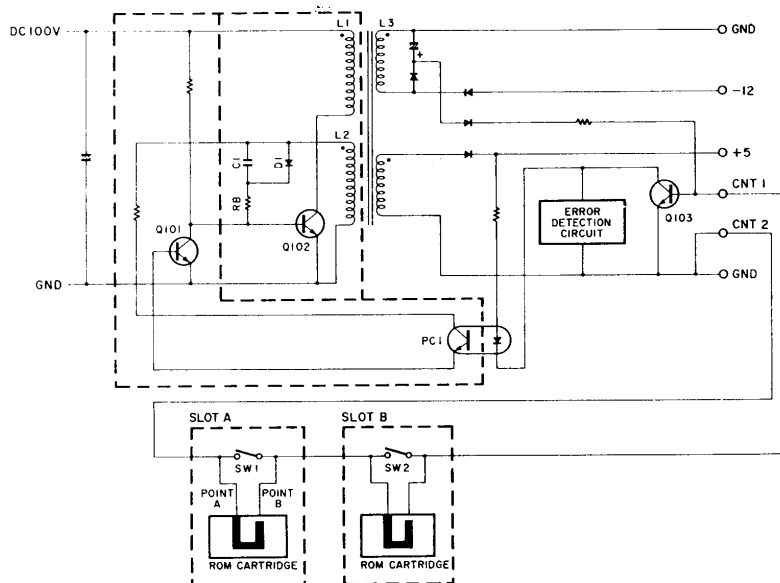
• Adjust VR101 so that the above listed voltages are obtained at each voltage output pin with each unit connected. Also, confirm that the output voltage is within the tolerance range even when the power voltage is 220 to 240V or 117V.

• Check to make sure that each output voltage is within the cartridge protect voltage when the micro switch of the upper slot is turned OFF (pressed) or the 9 pin circuit of CN102 is opened.

Circuit name	Voltage	Tolerance range	Cartridge protect voltage
-5V	+5V	$\pm$ 5V	Within 1V
+12V	+12V	$\pm$ 12.5V	Within 2V
-12V	-12V	$\pm$ 12.5V	Within 2V



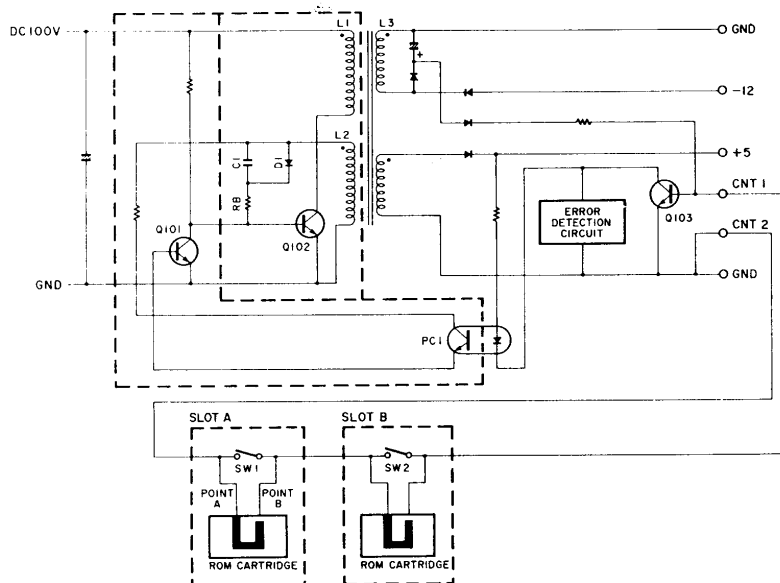
## ■ OPERATION OF POWER SUPPLY CIRCUIT



The following is the destination and operation of the circuit.

1. In D1, C1 and RB are the base drive circuits, and the base current of Q102 is determined by RB.
2. Q101 operates as a voltage controller and cartridge protector.
3. The photocoupler (PC1) feeds the voltage fluctuation of +5V back to the control circuit through the error detection circuit at all times. The control circuit controls output, based on the information fed back, by increasing and decreasing the base current of Q101 changing the oscillating frequency of Q102.
4. SW1, SW2 connected to Q103 in the cartridge protector circuit is ON at all times.
5. When Q103 is ON and the ROM cartridge is set in the slot-A erroneously, SW1 is turned OFF. Next, Q103 is turned ON, and the current flowing in the photocoupler (PC1) increases. Then, the photocoupler (PC1) on the control circuit is turned ON to turn ON Q101. The oscillating frequency of Q102 increases, the energy stored in L1 decreases, and output voltage lowers. When the ROM cartridge is properly set afterwards, A and B points in Fig.A are short-circuited, and voltage increases again.

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## ■ LSI DATA TABLE

### • CPU (LH0080A)

PIN NO.	PIN NAME	I/O	ACTIVE	FUNCTION
1 ~ 5	A11, 12, 13, 14, 15	O		Address bus
6	$\phi$	I		CPU clock input (3.579545MHz)
7 ~ 10	CD4, 3, 5, 6	I/O		Data bus
11	VDD	I		Voltage Supply +5V
12 ~ 15	CD2, 7, 0, 1	I/O		Data bus
16	INT	I	L	Maskable interrupt input pin: Mode 1 is used for interrupt of MSX-BASIC which is input by taking the logic OR of the VDP interrupt output (every 1/60s.) and the cartridge interrupt input (EXT INT)
17	NMI			Non-connect
18	HALT			Non-connect
19	MREQ	O	L	Active when the effective address for memory access is on the address bus.
20	IORQ	O	L	Active when the effective address for the input/output port access is on the address bus (also active when in INT or ACK cycle)
21	RD	O	L	Active during the period when the CPU can receive data from the memory and input/output port.
22	WR	O	L	Active when the CPU sends data to be stored in the memory and input/output port to the data bus.
23	BUSAK			Pull up (+5V)
24	WAIT	I	L	CPU remains in the wait state as long as this signal is active "L". (No refresh signal is generated when in the WAIT state.)
25	BUSRO			Non-connect
26	RESET	I	L	The program counter becomes "0" at the RESET input and the CPU is initialized.
27	M1	O	L	One "L" pulse is output at each instruction fetch cycle (also active when in the INT or ACK cycle)
28	RFSH	O	L	Active when the low order 7 bit refresh address for D-RAM is on the address bus
29	Vss	I		Ground
30 ~ 40	A0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10	O		Address bus

### • MPS (S3527)

PIN NO.	PIN NAME	I/O	ACTIVE	FUNCTION
1	CMI	I		Read signal input from cassette tape
2	CMO	O		Write output to cassette tape
3	REM	O		Cassette control signal output (motor ON/OFF control)
4	PRISND	O		Software-controlled sound output
5	SSGSND	O		SSG analog sound output
6	Vss			OV SSG ground
7	VDPCW	O		VDP (Video Display Processor) write timing signal output
8	VDPCR	O		VDP read timing signal output
9	RSEL	I	*	Slot expansion address input
10 ~ 18	AB15 ~ AB0	I		Z80A CPU address bus input (9 bits) (AB15, AB14, AB7, AB6, AB5, AB4, AB3, AB1, AB0)
19 ~ 26	DB7 ~ DB0	I/O		Z80A CPU data bus I/O (8 bit)
27	SLT03/33	O		Expanded slot 03 select signal
28	SLT01/31	O		Expanded slot 01 select signal
29	$\phi$ OUT	O		Z80A CPU clock output
30	$\phi$ IN	I		Clock input (This signal is used via a buffer for clock input to other than the Z80A).
31	Vss			OV ground
32	RST O	O		Slot expansion initialization signal input
33	RST I	I	*	Slot expansion initialization signal input (RESET signal input)
34	M1	I		Z80A CPU M1 input
35	RFSH	I		Z80A CPU RFSH input
36	MREQ	I		Z80A CPU input
37	IORQ	I		Z80A CPU IORQ input
38	RD	I		Z80A CPU RD input
39	WR	I		Z80A CPU WR input
40	VDD			+5V power supply

PIN NO.	PIN NAME	I/O	ACTIVE	FUNCTION
41	WAIT	O	*/ $\Delta$	1WAIT request signal output in M1 cycle (Wired logic with external WAIT signal possible)
42	ROMCS	O		MSX BASIC ROM select signal output
43	RAS	O		D-RAM RAS signal output (with Z80 RAS only refresh function)
44	MPX	O		D-RAM address multiplex signal output
45	CAS3	O		D-RAM CAS signal output (CAS3: SLOT #0 C000 ~ FFFF)
46	CAS2/E	O		D-RAM CAS signal output (CAS2/E: SLOT #32 0000 ~ FFFF)
47	WE	O		D-RAM write enable signal output
48	FWD 1	I	*	JOYSTICK FWD 1 signal or general-purpose port input
49	BACK 1	I	*	JOYSTICK BACK 1 signal or general-purpose port input
50	LEFT 1	I	*	JOYSTICK LEFT 1 signal or general-purpose port input
51	RIGHT 1	I	*	JOYSTICK RIGHT 1 signal or general-purpose port input
52	TRGA 1	I/O	*/ $\Delta$	JOYSTICK TRGA 1 signal or general-purpose port output (I/O by wired logic)
53	TRGB 1	I/O	*/ $\Delta$	JOYSTICK TRGB 1 signal or general-purpose port output (I/O by wired logic)
54	STB 1	O		General-purpose port output
55	FWD 2	I	*	JOYSTICK FWD 2 signal or general-purpose port input
56	BACK 2	I	*	JOYSTICK BACK 2 signal or general-purpose port input
57	LEFT 2	I	*	JOYSTICK LEFT 2 signal or general-purpose port input
58	RIGHT 2	I	*	JOYSTICK RIGHT 2 signal or general-purpose port input
59	TRGA 2	I/O	*/ $\Delta$	JOYSTICK TRGA 2 signal or general-purpose port output (I/O by wired logic)
60	TRGB 2	I/O	*/ $\Delta$	JOYSTICK TRGB 2 signal or general-purpose port output (I/O by wired logic)
61	STB 2	O		General-purpose port output
62	Y10/SK		*/ $\Delta$	Not used (Keyboard scanning signal output (1 bit))
63	JIS/50	I	*	Keyboard layout control input
64	CAPS	O	$\Delta$	CAPS LED control signal output (Direct lighting of LED possible)
65	CODE	O	$\Delta$	CODE LED control signal output (Direct lighting of LED possible)
66 ~ 73	X0 ~ X7	I	*	Keyboard return signal input (8 bits) (X6 serves as function select input on a reset.)
74 ~ 83	Y0 ~ Y9	O	$\Delta$	Keyboard scanning signal output (10 bits)
84	CS1	O		ROM select signal output (4000 ~ 7FFF)
85	CS2	O		ROM select signal output (8000 ~ BFFF)
86	CS12	O		ROM select signal output (4000 ~ BFFF)
87	SLT1	O		Slot select signal output (SLOT #1)
88	SLT2	O		Slot select signal output (SLOT #2)
89	SLT3/30	O		Slot select signal output (SLOT #3)
90	VDD			+5V power supply
91	BUSY	I	*	Printer status input
92 ~ 99	PD87 ~ PD80	O		Print data output (8 bits)
100	PSTB	O		Printer strobe output

Note) \* With pullup resistor ( $\approx 22K$ )  $\Delta$  Open Drain (Pull Down) OUTPUT

• VDP (V9938)

PIN NO.	PIN NAME	I/O	FUNCTION
1	GND		Ground
2	DHCLK	O	Not used
3	DLCKL	I/O	
4	VDS	O	Not used
5	HSYNC	I/O	High level (high to middle): output, low level (middle to low): input (High: Non-HSYNC timing or color burst timing Middle: HSYNC timing or color burst timing Low: HSYNC input)
6	CSYNC	I/O	High level: composite SYNC output, low level: VSYNC input
7	BLEO	O	Not used
8	CPU CLK	O	1/6 X'TAL frequency output
9	RESET	I	MSX-VIDEO circuit initialization
10	YS	O	Not used
11	CBDR	O	Not used
12 ~ 19	C7 ~ C0	I/O	Not used
20	GND		DAC ground
21	VIDEO	O	Not used (Composite video signal output)
22	G	O	Linear RGB signal output
23	R	O	Linear RGB signal output
24	B	O	Linear RGB signal output
25	INT	O	CPU interrupt request signal output (low: Interrupt-request)
26	LPS	I	Not used
27	LPD	I	Not used
28	MODE 1	I	CPU interface mode select signal
29	MODE 0	I	CPU interface mode select signal
30	CSW	I	CPU-VDP write strobe
31	CSR	I	CPU-VDP read strobe
32	CD7	I/O	CPU data bus
33	VBB	O	Circuit board voltage
34 ~ 40	CD0 ~ CD6	I/O	CPU data bus
41 ~ 48	RD0 ~ RD7	I/O	VRAM data bus
49 ~ 56	AD0 ~ AD7	O	VRAM address bus
57	R/W	O	VRAM write strobe
58	Vcc		+5V power supply
59	CASX	O	Not used
60	CAS1	O	Not used
61	CAS0	O	VRAM column address strobe
62	RAS	O	VRAM low address strobe
63	XTAL 1	I	X'TAL connection (Externally oscillated clock is input to this pin.)
64	XTAL 2	I	X'TAL connection (Externally oscillated clock is input to this pin.)

Note) \* With pullup resistor ( $\approx 22k$ )     $\Delta$  Open Drain (Pull Down) OUTPUT

• 16Kbit  $\times$  4 DRAM (MB81416-12)

PIN NO.	PIN NAME	I/O	ACTIVE	FUNCTION
1	OE	I		Output enable
2, 3	DQ1, DQ2	I/O		Data output
4	WE	I		Write enable, write mode at active "L"
5	RAS	I		Lower address strobe
6 ~ 8	A6, 5, 4	I		Address input
9	VDD			Voltage Supply +5V
10 ~ 14	A7, 3, 2, 1, 0	I		Address input
15	DQ3	I/O		Data output
16	CAS	I		Column address strobe
17	DQ4	I/O		Data output
18	Vss			Ground

Note) MB81416 is an N channel MOS RAM consisting of 16384 word  $\times$  4 bit. RAS only refresh type, write cycle (early write) type.

• 64Kbit DRAM (MB8264)

PIN NO.	PIN NAME	I/O	ACTIVE	FUNCTION
1	N.C			Non-Connect
2	D in	I		Data input
3	WE	I	L	Write enable, write mode to D-RAM at active "L"
4	RAS	I	L	Lower address strobe
5~7	A0, 2, 1	I		Address bus input
8	Vcc			+5V
9~13	A7, 5, 4, 3, 6	I		Address bus input
14	D out	O		Data output
15	CAS	I	L	Column address strobe
16	Vss			Ground

• DAC (YM3012)

PIN NO.	PIN NAME	I/O	FUNCTION
1	VDD	—	+5V power
2	CLOCK	I	Timing clock for synchronizing with OPE
3	GND	—	
4	DATA	I	Tone serial data
5	SAM2	I	Sampling data (for LR separator)
6	SAM1	I	Sampling data (for LR separator)
7	ICL	I	Initial clear
8	GND	—	Ground for analog
9	CH1	O	1CH (L-CH) analog signal
10	CH2	O	2CH (R-CH) analog signal
11	COM	O	Offset control
12	To BUF	O	Offset control
13	Mid-point	O	Offset control
14	BIAS compensation	O	Offset control
15	BIAS	O	Offset control
16	GND	—	

• MKS (YM2148)

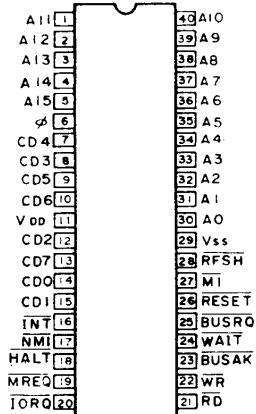
PIN NO.	PIN NAME	I/O	FUNCTION	REMARKS
1	Vss	—	Ground	
2 ~ 4	A <sub>0</sub> ~ A <sub>2</sub>	I	Selection signal for internal registers	
5	CS	I	Chip select	
6	WT	I	Write request for data from CPU	
7	RD	I	Read request for data from CPU	
8	OPM	O	Address decode out to OPM	Output when A <sub>0</sub> to A <sub>1</sub> address input is 0 or 1.
9 ~ 16	ST <sub>0</sub> ~ ST <sub>7</sub>	O	Used as strobe output to keyboard	Latch output ports in 2nd address
17	VDD	—	+5V power	
18	RXD	I	MIDI serial data	
19 ~ 26	SD <sub>0</sub> ~ SD <sub>7</sub>	I	Data input port	Data input ports to 2nd address
27	TXD	O	MIDI serial data	
28 ~ 35	D <sub>0</sub> ~ D <sub>7</sub>	I/O	3-state data bus I/O ports	
36	VR	I	VECTOR ADDRESS REQUEST	Used for Z-80 MODE 2, IRQ
37	IRQ	O	Interrupt request generated when receiving and transmitting MIDI signal	Maskable
38	TC	I	"L" reset data IRQ "H", OPM "H"	ST <sub>0</sub> ~ ST <sub>7</sub> "H", D <sub>0</sub> ~ D <sub>7</sub> "Hi impedance"
39	φA	I	Clock for MIDI baud rate generation	
40	φ	I	CPU Master clock for synchronizing with CPU	

• OPM (YM2151)

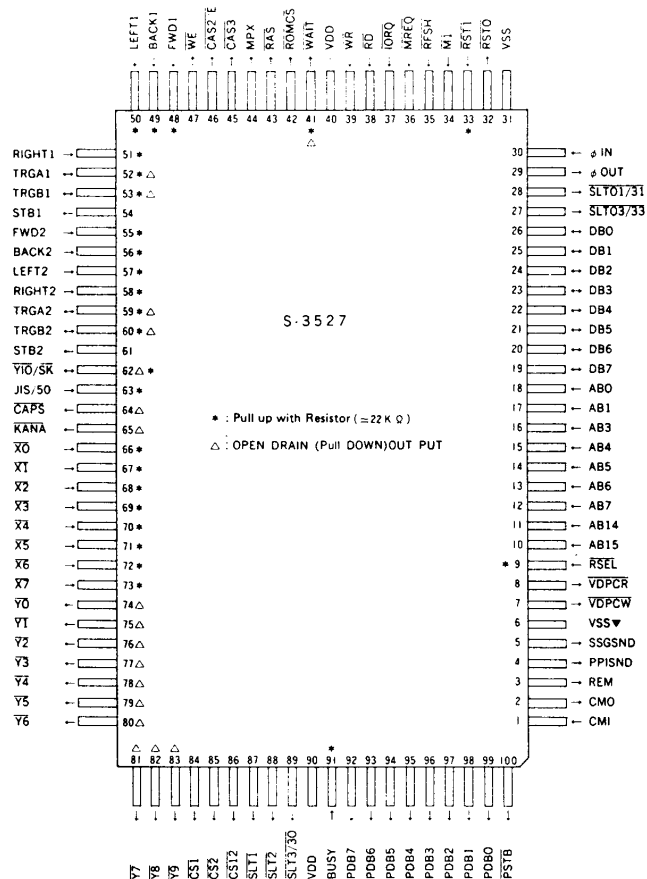
PIN NO.	PIN NAME	I/O	FUNCTION	REMARKS
1	Vss	—	Ground	
2	IRQ	I	Interrupt request output port	
3	TC	I	"L" reset	
4	A <sub>0</sub>	I	Selection signal for internal register	
5	WT	I	Write request for data from CPU	
6	RD	I	Read request for data from CPU	
7	CS	I	Chip select	
8			Not used	
9	CT1	O	Signal for switching voice synthesis filter characteristics	
10	D <sub>0</sub>	I/O	3-state data bus I/O port	
11	Vss	—	Ground	
12 ~ 18	D <sub>1</sub> ~ D <sub>7</sub>	I/O	3-state data bus I/O ports	
19	SH1	O		
20	SH2	O	Signal for separating L and R	
21	S <sub>0</sub>	O	Serial data for sound source (L, R)	
22	VDD	—	+5V power	
23	φ1	O	Clock for DAC synchronization	
24	φ	I	CPU Master clock for synchronizing with CPU	

## LSI PIN CONFIGURATION

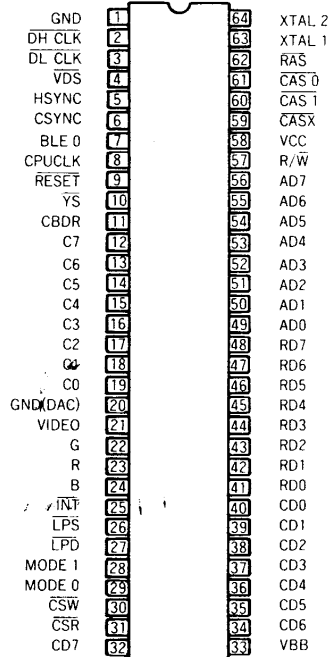
**Z-80A  
(CPU)**



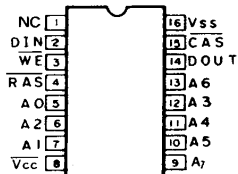
**S3527 (MPS)**



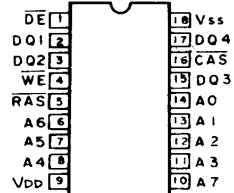
**V9938  
(VDP)**



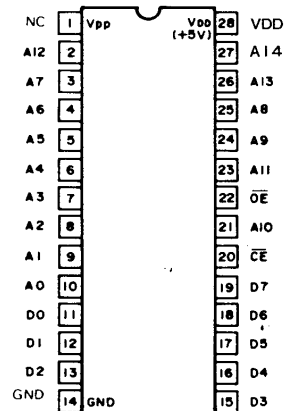
**MB8264  
(RAM)**



**MB81416-12  
(RAM)**



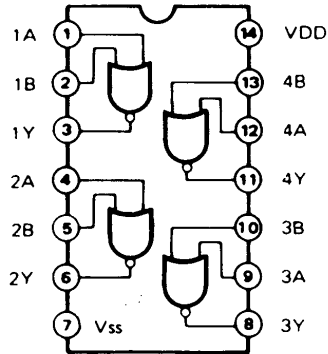
**256K bit  
(EP-ROM)**



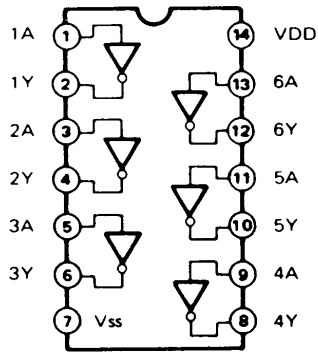


## ■ IC DIAGRAM

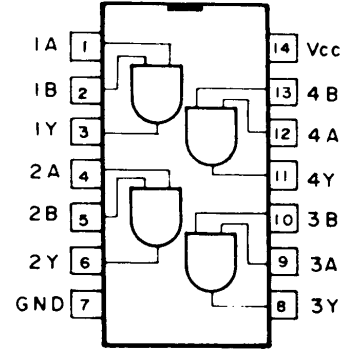
- HD74LS02  
Quad 2-Input NOR



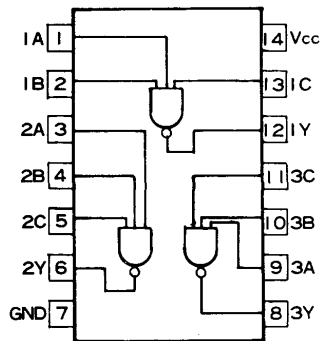
- HD74S04  
• HD74LS04  
Hex Inverters



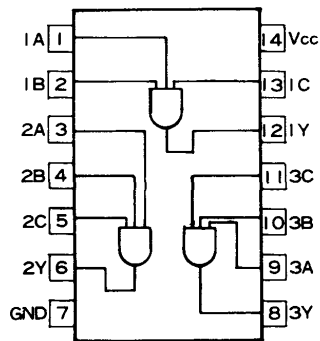
- 74LS08  
Quad 2-Input NAND



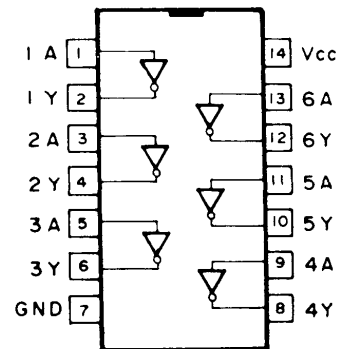
- 74LS10  
Tri 3-Input NAND



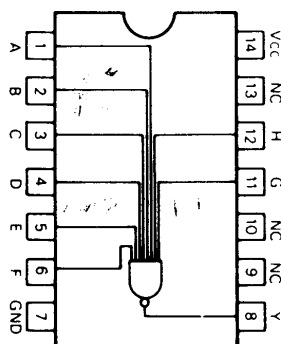
- HD74LS11  
Tri 3-Input AND



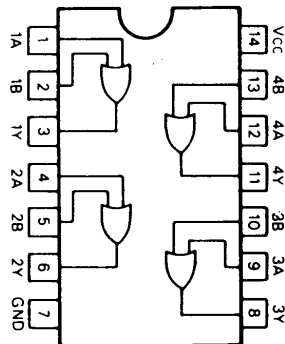
- 74LS14  
Hex Schmitt  
Trigger Inverters



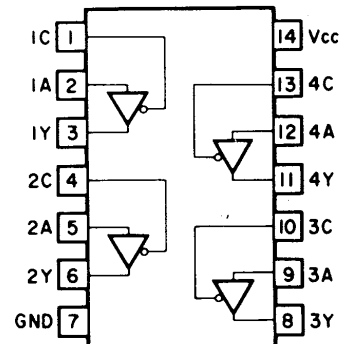
- 74LS30  
8 Input NAND



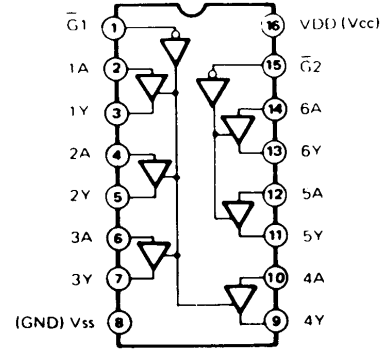
- 74LS32  
Quad 2-Input OR



- 74LS125  
Quad 3 State Bus Buffers

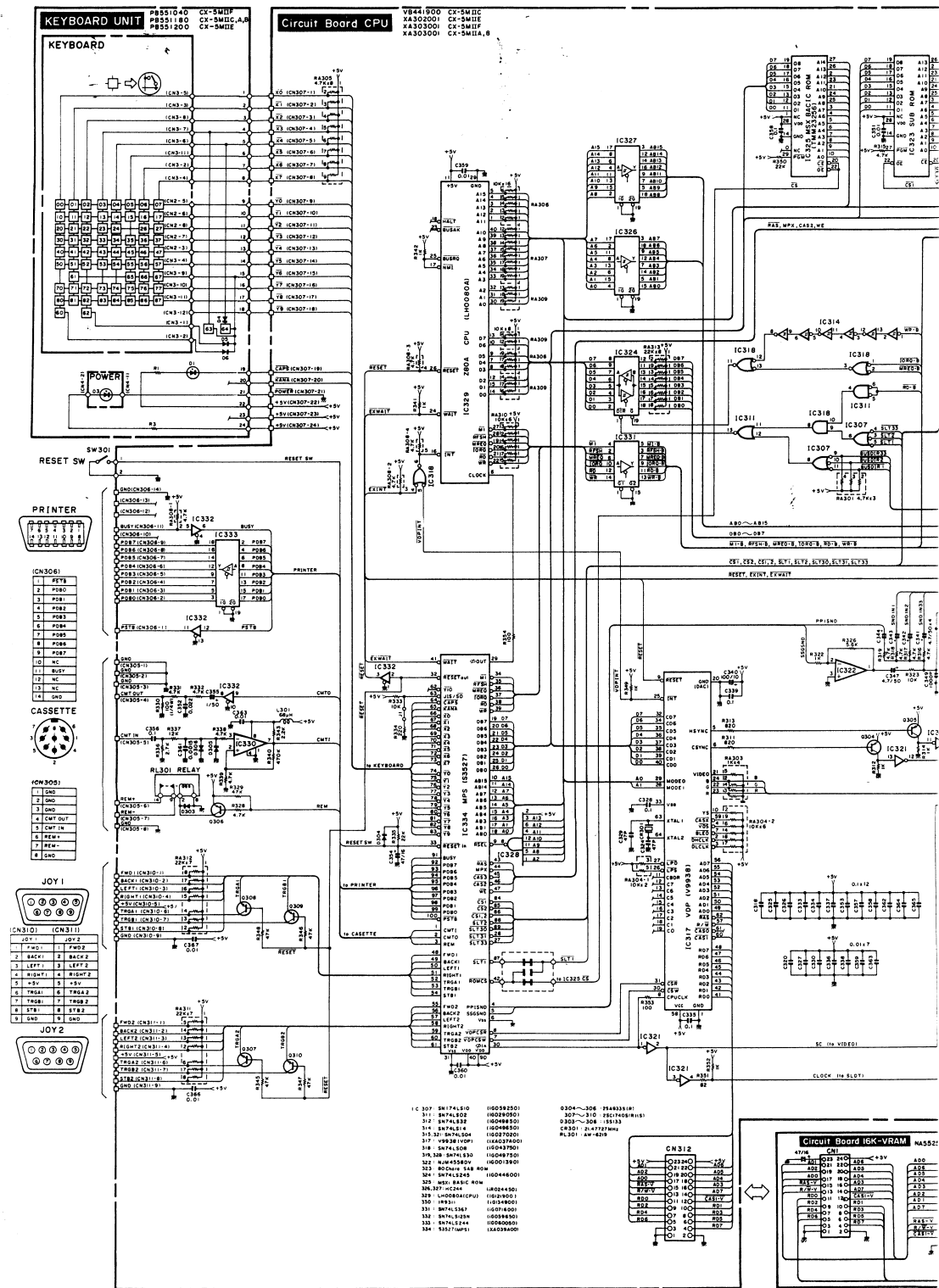


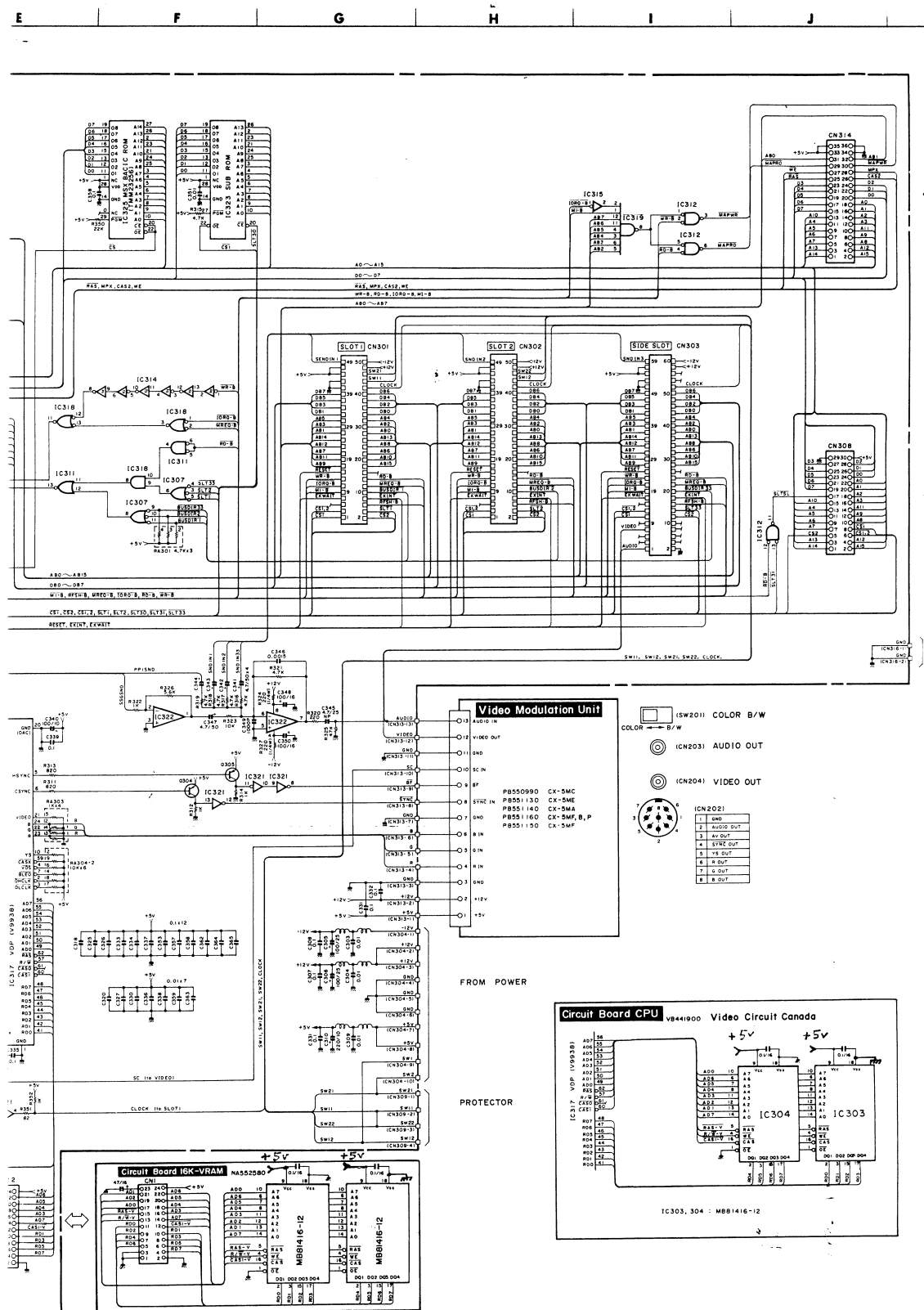
- 74LS367  
Hex 3 State Bus Buffers

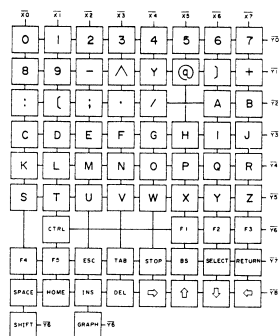
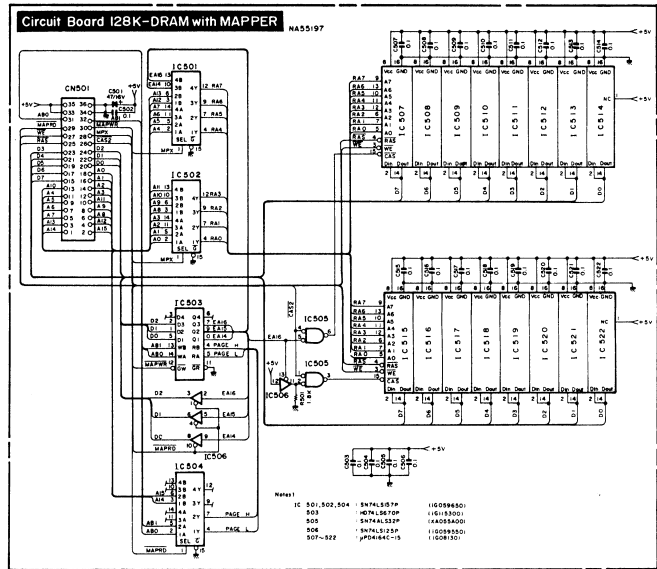
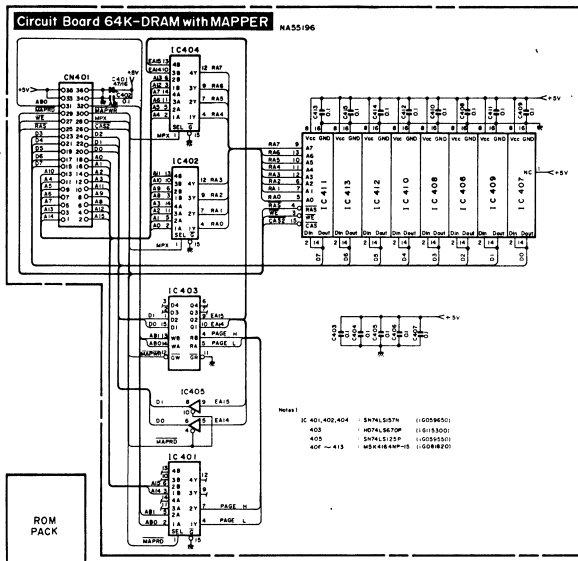
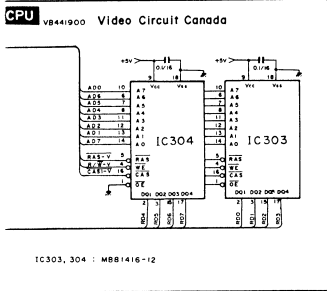
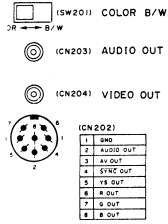
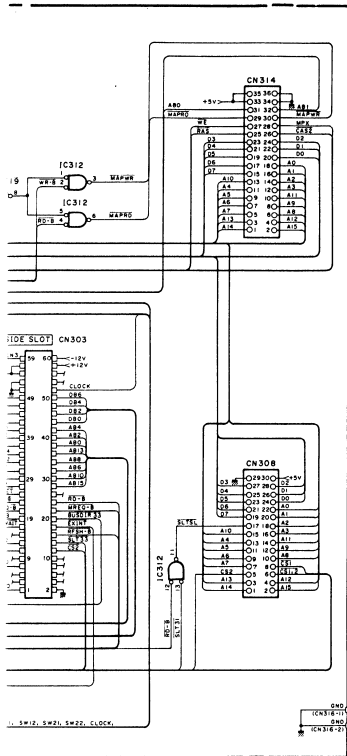


- [illegible]

## ■ CX-5M II 64K/128 SCHEMATIC CIRCUIT DIAGRAM

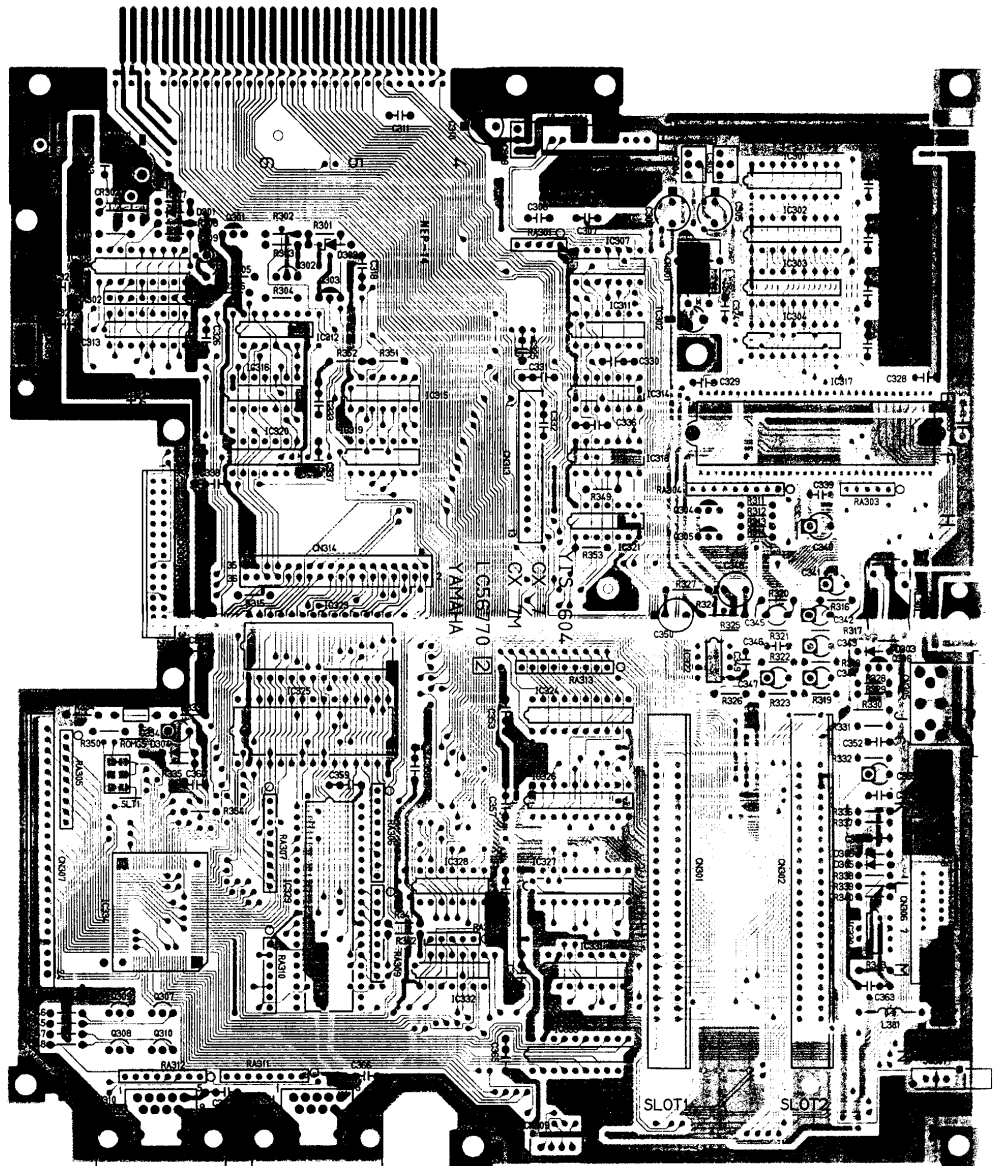




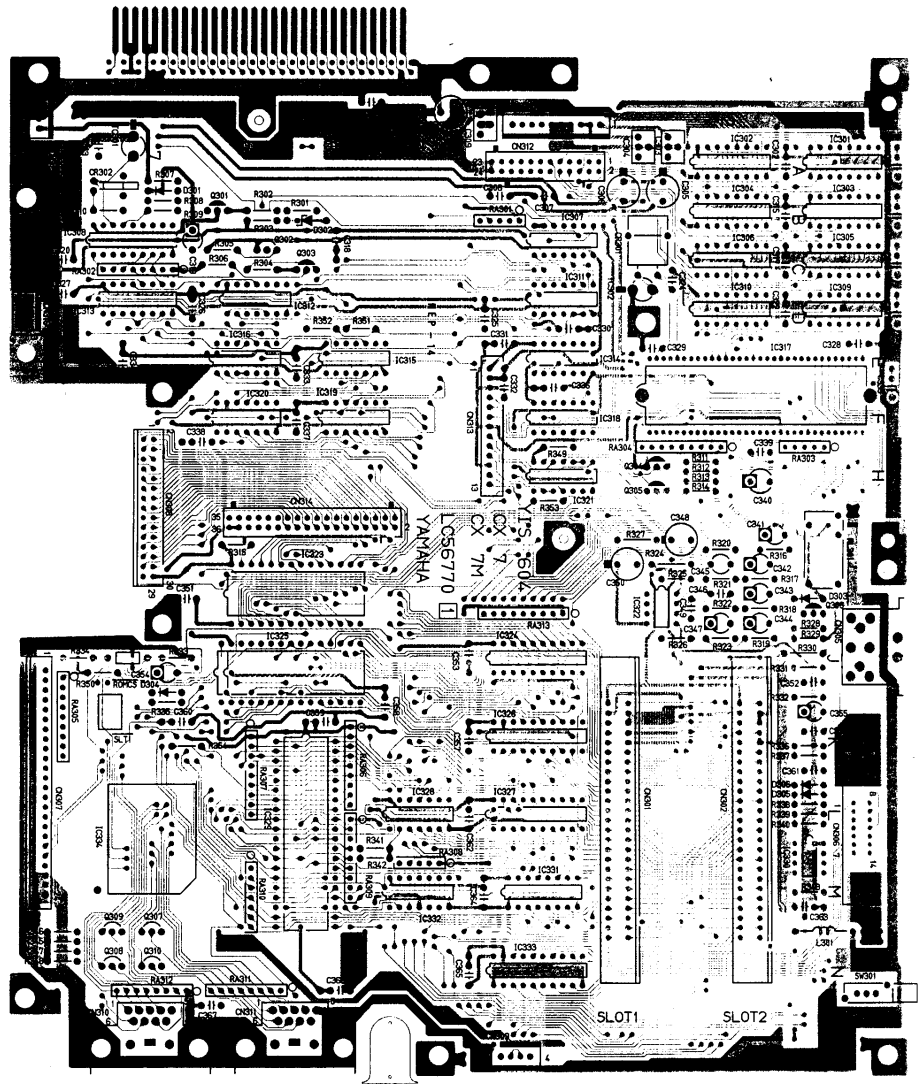




■ CX-5M11C CIRCUIT BOARD



■ CX-5M II E, A, F, B, P CIRCUIT BOARD

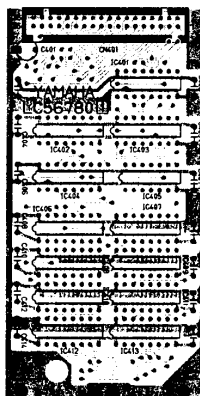




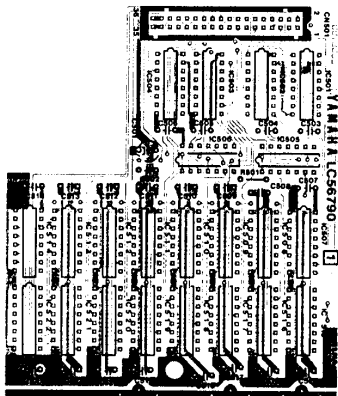
■ 16K V-RAM CIRCUIT BOARD



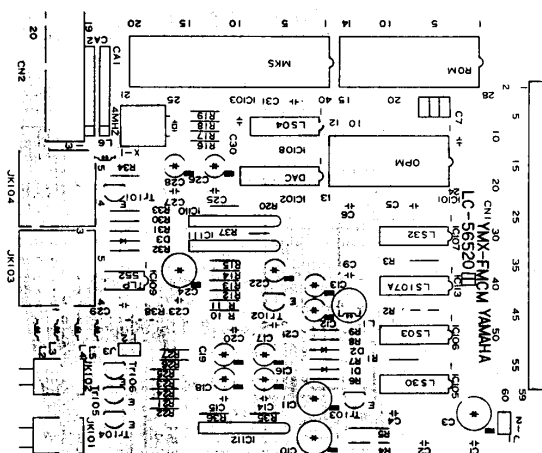
■ 64K DRAM CIRCUIT BOARD



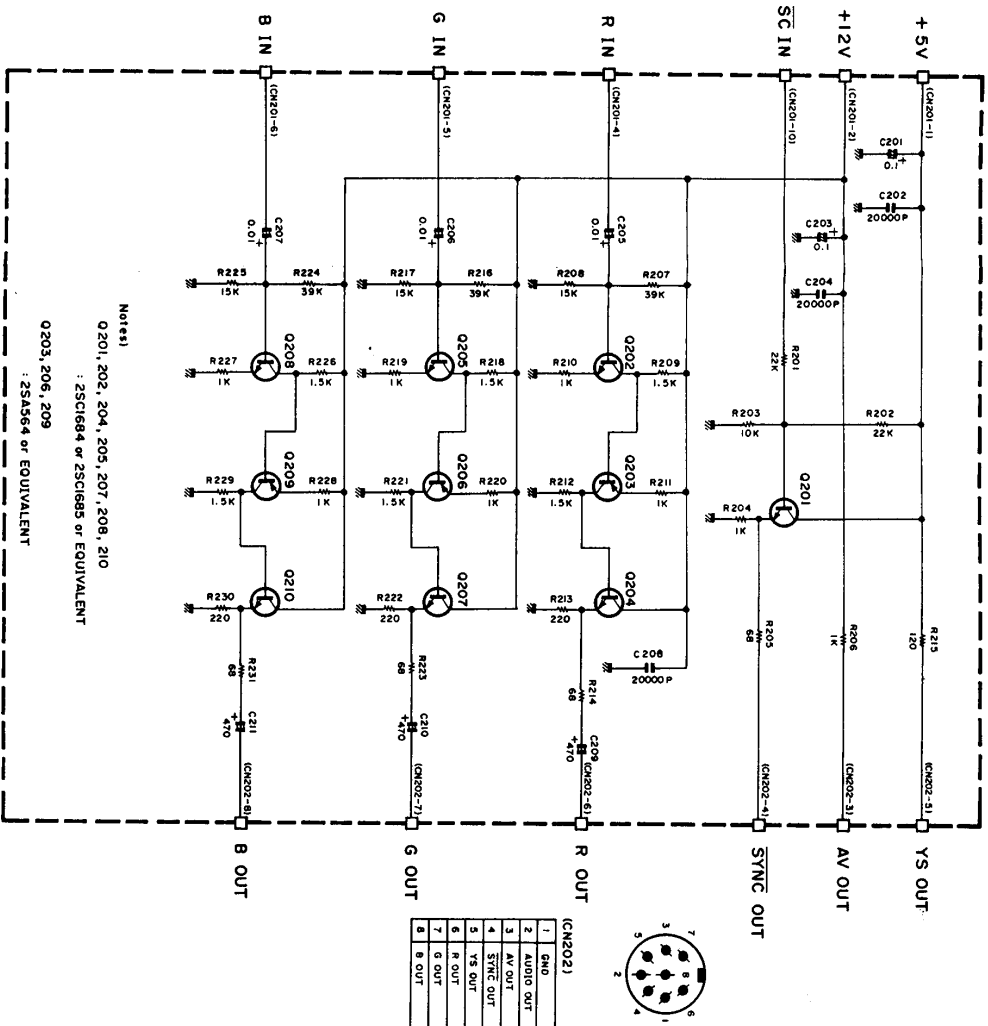
■ 128K DRAM CIRCUIT BOARD WITH MAPPER



■ CIRCUIT BOARD (FM SOUND UNIT)

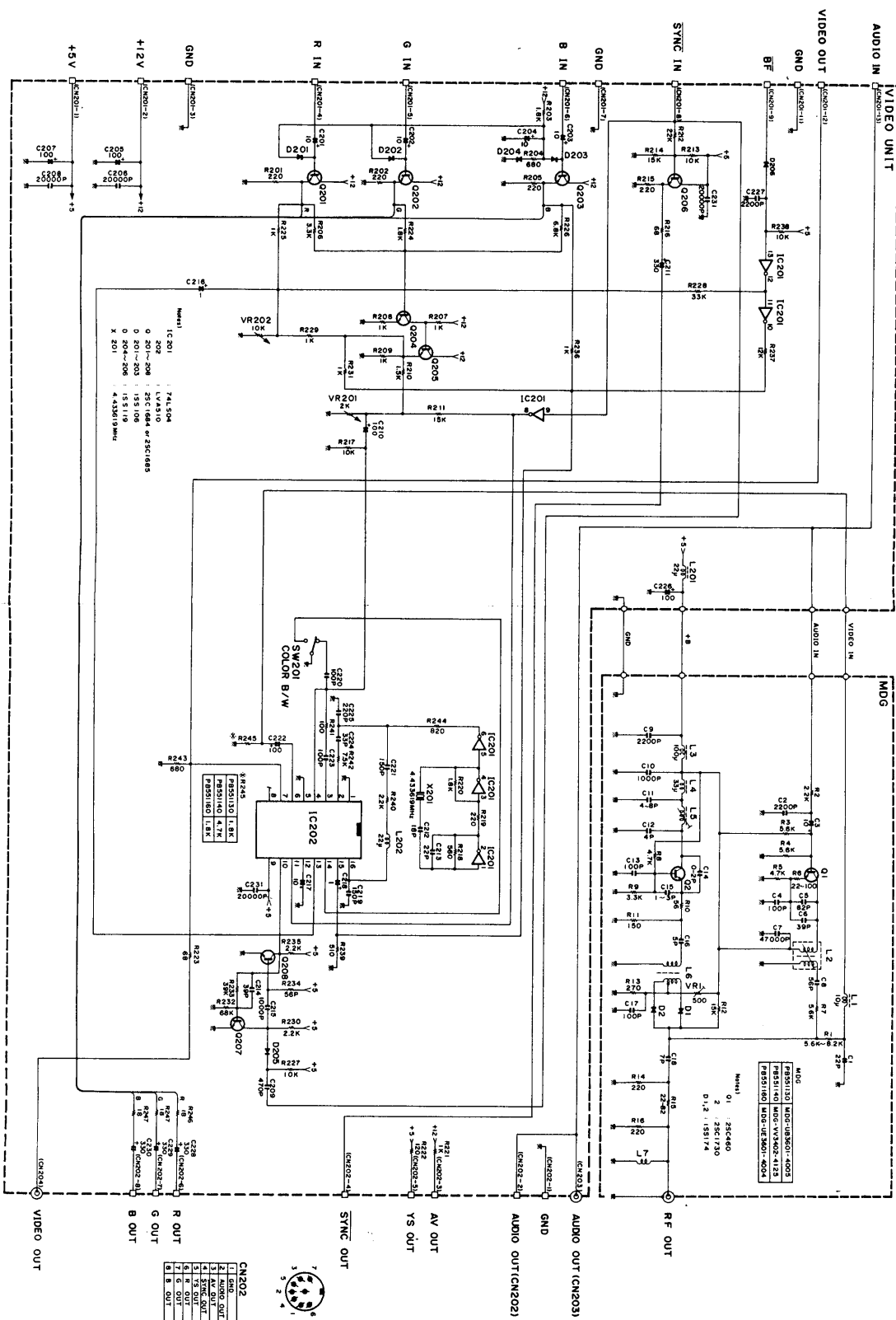


● PB551150 (CX-5M11F) old

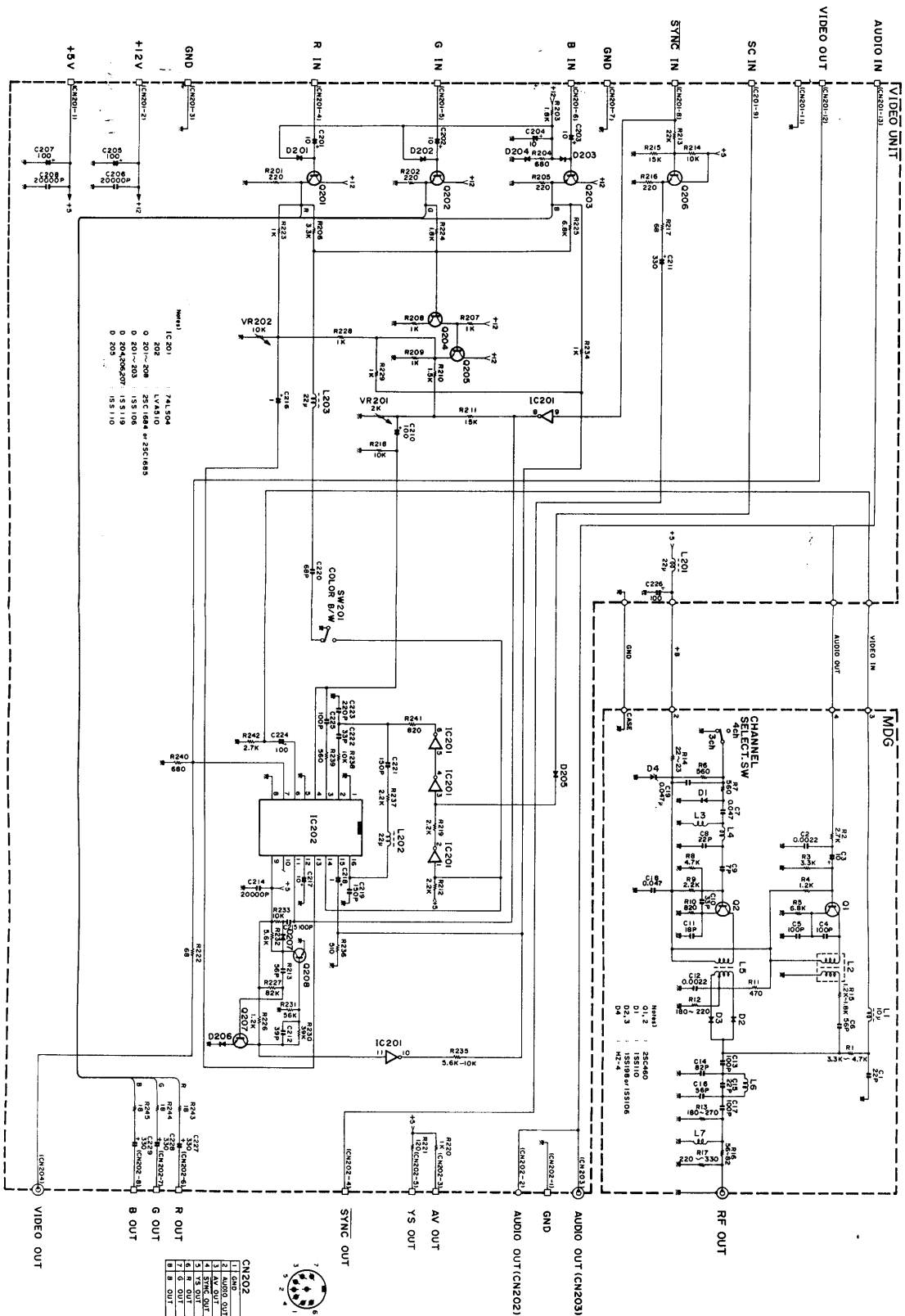


●PB551130 (CX-5MII E), PB551140 (CX-5MII A), PB551160 (CX-5MII F,B,P)

VIDEO UNIT  
(ACN201-13)

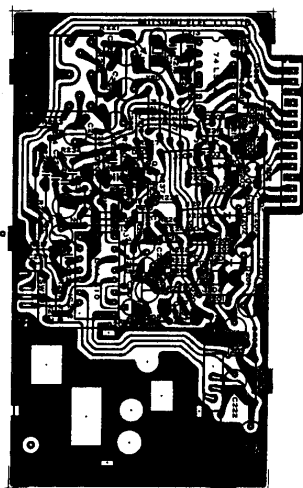


●PB550990 (CX-SM11C)

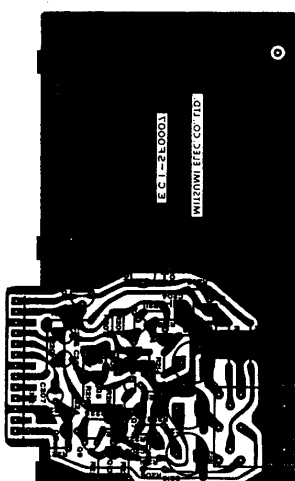


■ CX-5MII CIRCUIT BOARD

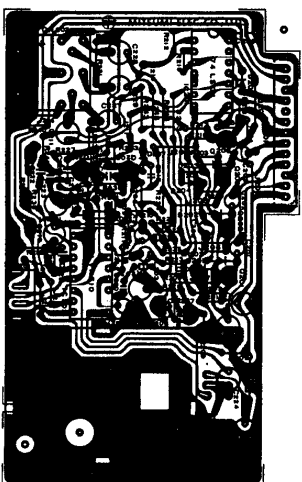
- PB551130 (CX-5MII E)
- PB551140 (CX-5MII A)
- PB551160 (CX5MII F, B, P)



- PB551150 (CX5MII F) old

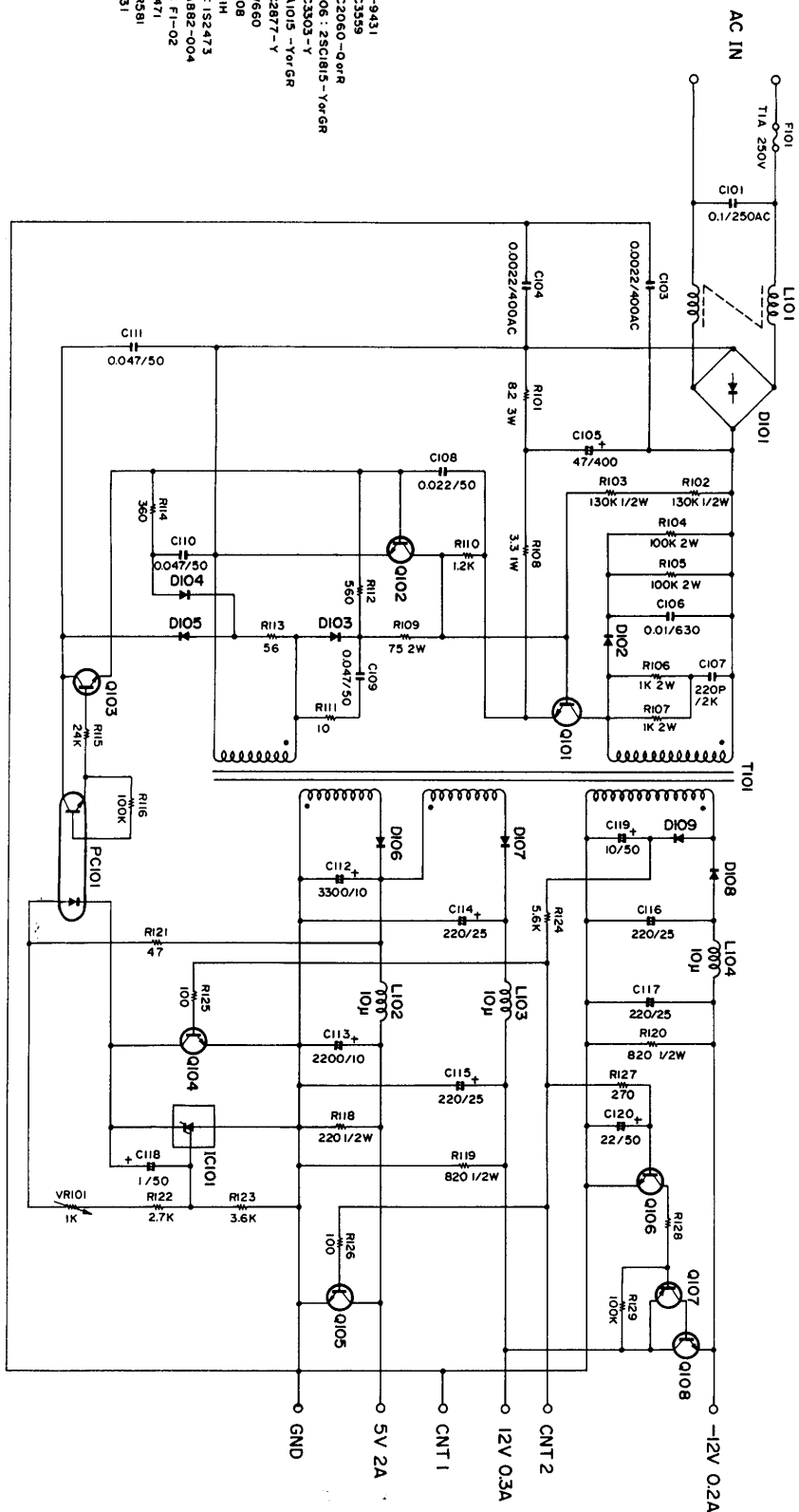


- PB550990 (CX-5MII C)



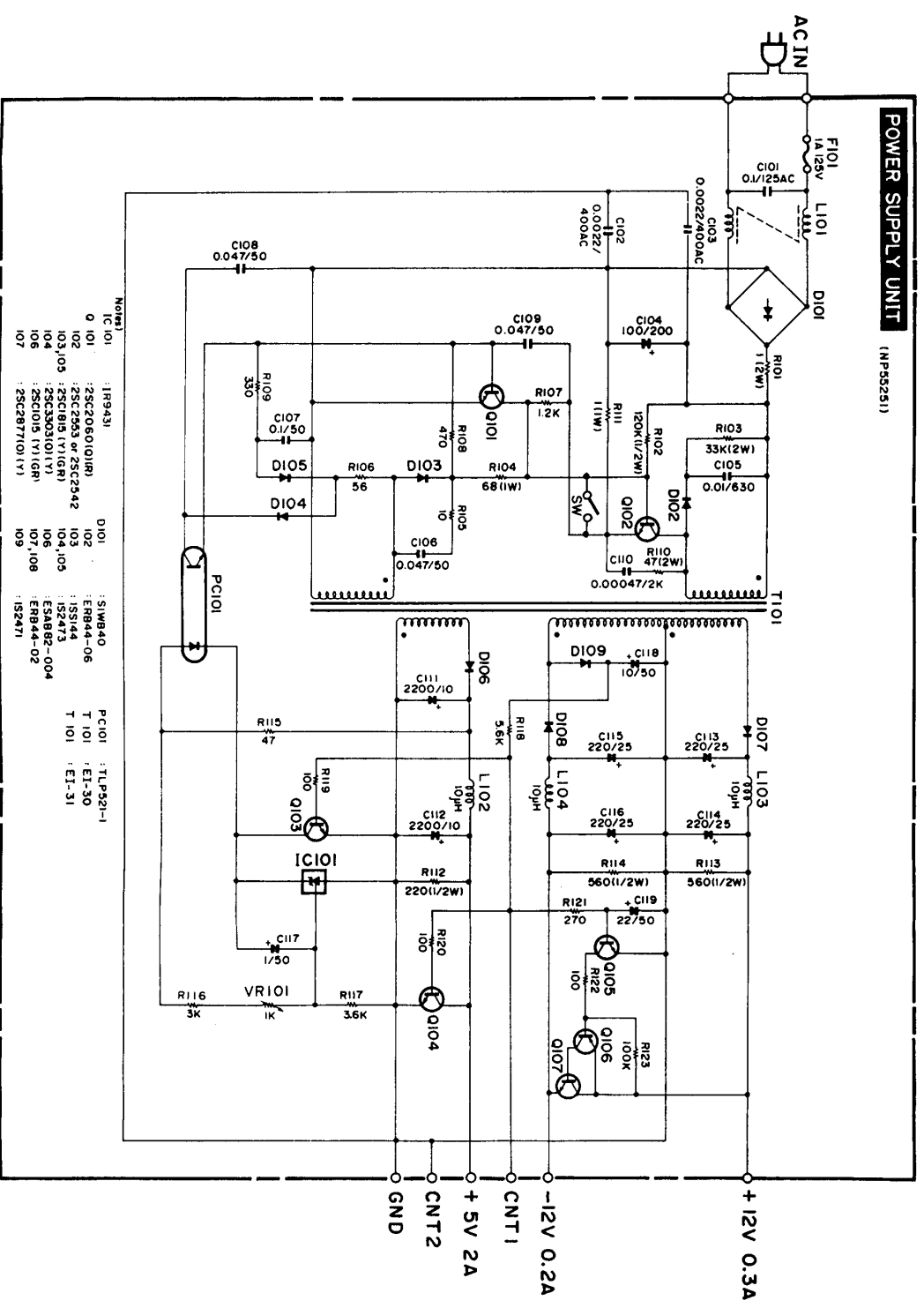
# POWER SUPPLY UNIT OVERALL CIRCUIT DIAGRAM

● NP552200 (CX-5M E.A.F)



- Notes)
- IC101 : 1R-9431
  - Q101 : 2SC3359
  - Q102 : 2SC2060-QGR
  - Q103, Q104, Q106 : 2SC1815-YGR
  - Q105 : 2SC3303-Y
  - Q107 : 2SA1015-YGR
  - Q108 : 2SC2877-Y
  - D101 : 51W660
  - D102 : FI-08
  - D103 : 1S51H
  - D104, D105 : 1S2473
  - D106 : ESAB82-004
  - D107, D108 : FI-02
  - D109 : 1S2471
  - PC101 : TLRS81
  - T101 : EF-51

● NP552500 (CX-5M C)



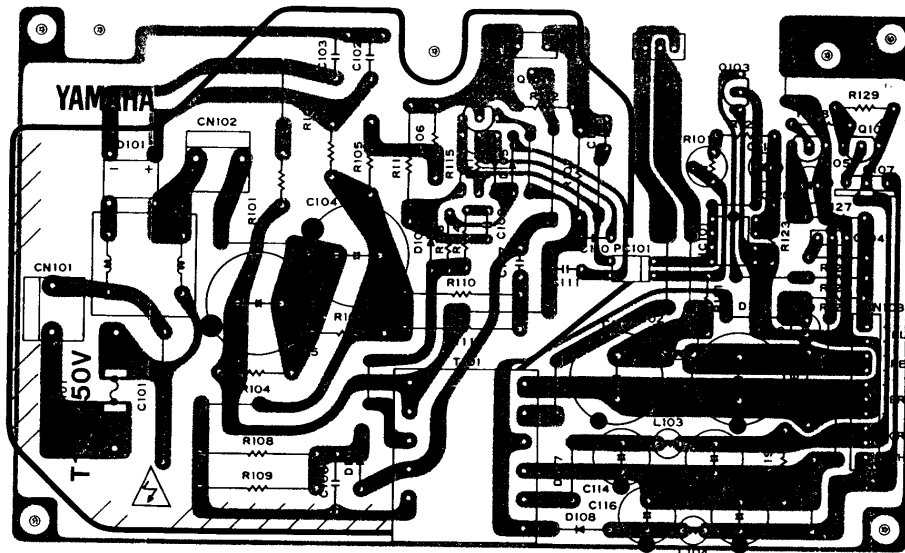
**POWER SUPPLY UNIT**  
(MP55240)





## ■ POWER SUPPLY UNIT CIRCUIT BOARD

● NP552400 (CX-5M B,P)



● NP552500 (CX-5M C)

